EAST WATERWAY PHASE 1 REMOVAL ACTION: RECONTAMINATION MONITORING PLAN

FINAL

For submittal to

US Environmental Protection Agency Region 10
1200 Sixth Avenue
Seattle, WA 98101

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East Waterway Phase 1 Removal Action:
Recontamination Monitoring Plan

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Acronyms

%RSD	percent relative standard deviation
ARI	Analytical Resources, Inc.
COC	chain of custody
CSL	cleanup screening level
cy	cubic yards
DGPS	differential global positioning system
DMMP	Dredged Material Management Program
DMMU	dredged material management unit
DQO	data quality objective
Ecology	Washington Department of Ecology
EE/CA	engineering estimate / cost analysis
EPA	U.S. Environmental Protection Agency
EWW	East Waterway Operable Unit of the Harbor Island Superfund site
FC	field coordinator
GPS	global positioning system
HSP	health and safety plan
MDL	method detection limit
ML	DMMP maximum level guideline
MLLW	mean lower low water
NTCRA	non-time-critical removal action
OSHA	Occupational Health and Safety Administration
PCB	polychlorinated biphenyl
PDM	East Waterway Phase 1 Post-dredge Monitoring Program
Port	Port of Seattle
PSDDA	Puget Sound Dredged Disposal Analysis Program
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance / quality control
QAPP	quality assurance project plan
RMP	recontamination monitoring plan
RPD	relative percent difference
SDG	sample delivery group
SL	DMMP screening level guideline
SMS	Washington State Sediment Management Standards
SQS	sediment quality standards of SMS
SVOC	semivolatile organic compound
TBT	tributyltin
TOC	total organic carbon
Windward	Windward Environmental LLC

1.0 Introduction

The purpose of this Quality Assurance Project Plan (QAPP) is to present the Port of Seattle's recontamination monitoring plan for the new sediment surface in the East Waterway Operable Unit of the Harbor Island Superfund site (EWW). The goal of the QAPP is to ensure that sediment data of sufficiently high quality are generated to support the project data quality objectives (DQOs). The QAPP will address project management responsibilities, sampling and analytical procedures, assessment and oversight, and data reduction, validation, and reporting.

The QAPP was prepared following US Environmental Protection Agency (EPA) guidance, specifically Guidance for Quality Assurance / Project Plans (EPA 2002a). Analytical quality assurance / quality control (QA / QC) procedures were also developed based on the analytical protocols of the Puget Sound Estuary Program (PSEP 1986, 1997a, b, c) and EPA (1999; 2002b) Contract Laboratory Program.

This EWW recontamination monitoring plan QAPP is organized into the following sections:

- Section 2 – Project management
- Section 3 – Assessment and oversight
- Section 4 – Data generation and acquisition
- Section 5 – Data validation and usability
- Section 6 – References

A health and safety plan (HSP) is attached as Attachment A.

2.0 Project Management

2.1 Project Organization and Team Member Responsibilities

Figure 2-1 shows the overall project organization for the EWW post-dredge monitoring and the individuals responsible for the various tasks required for sediment sample collection and analysis. Responsibilities of these team members, as well as laboratory project managers, are described in the following paragraphs.

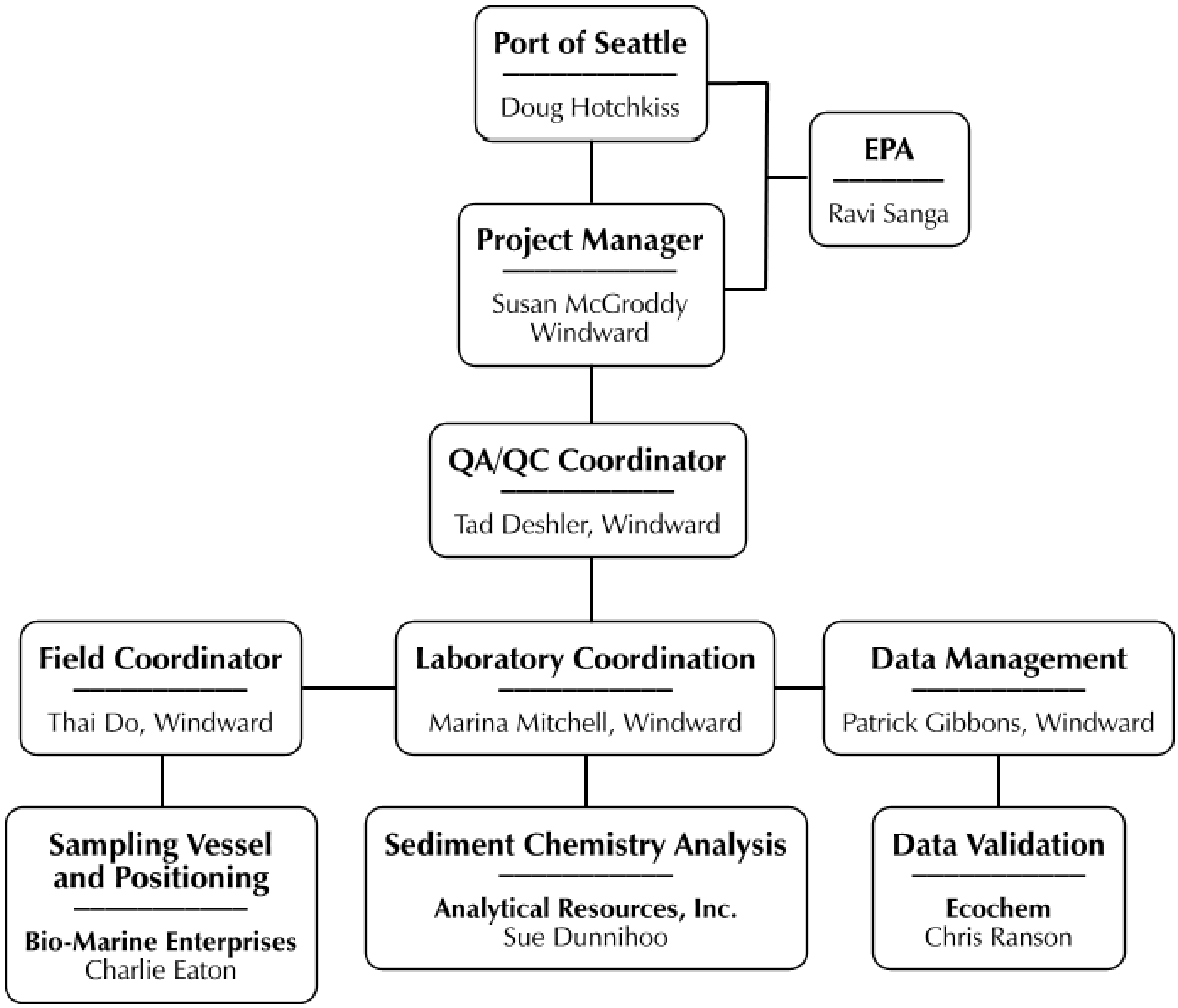

Figure 2-1. Project organization and team responsibilities

The Project Manager is Doug Hotchkiss of the Port of Seattle (Port), and the EPA Project Manager is Ravi Sanga. They will be involved in all aspects of the project, including reviewing and approving the QAPP and interpreting the results of the investigation. Personnel from the Sediment Management Program of the Washington State Department of Ecology (Ecology) will also be involved in contingency evaluations.

Susan McGroddy will serve as the Project Manager for Windward Environmental LLC (Windward). She will be responsible for overall project coordination, planning, and coordination; production of work plans; producing all project deliverables; and performing the administrative tasks needed to ensure timely and successful completion of the project.

Thai Do will be the Windward Field Coordinator (FC). The FC is responsible for day-to-day technical and QA/QC oversight. He will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical and physical analyses.

Tad Deshler will serve as the Windward QA/QC Coordinator. He will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratories, ensuring data quality, overseeing data validation, and supervising project QA coordination. Independent third-party data review and validation will be performed.

Analytical Resources, Inc. (ARI) of Seattle will perform chemical and geotechnical analyses of the sediment samples. Sue Dunnihoo will be ARI's Laboratory QA Coordinator.

The analytical testing laboratories will be responsible for the following:

- Perform the methods outlined in this QAPP, including those methods referenced for each analytical procedure
- Follow documentation, custody, and sample logbook procedures
- Implement QA/QC procedures required by the Puget Sound Estuary Program (PSEP) (PSEP 1986, 1997a, b, c) guidelines
- Meet all reporting requirements
- Deliver electronic data files as specified in this QAPP
- Meet turnaround times for deliverables as described in this QAPP
- Allow EPA and the QA/QC contractor to perform laboratory and data audits

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2.2 PROBLEM DEFINITION/BACKGROUND

EPA has ordered the Port of Seattle to address sediment contamination issues in the EWW site per the process defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Superfund. Based on a review of preliminary data collected, EPA has determined that a non-time-critical removal action (NTCRA) was warranted for a portion of the EWW. This NTCRA, termed in this document as the "Phase 1 Removal Action," was established in the engineering evaluation and cost analysis (EE/CA) submitted to EPA in July 2003 (Windward 2003b). The Phase 1 removal was conducted in two seasons from December 2003-March 2004 and July 2004-March 2005. The dredging resulted in the removal of 67,330 cy of material suitable for open-water disposal and 179,954 cy of material unsuitable for open-water disposal in order to achieve the project depth of -51 ft mean lower low water (MLLW). In addition, contingency dredging was conducted in areas identified based on the results of the East Waterway Phase 1 Post-dredge Monitoring Program (PDM) sampling and this resulted in the removal of an additional 26,038 cy of unsuitable material followed by the placement of 19,131 cy of clean sand material throughout the contingency dredge area.

PDM sampling was conducted to characterize the sediment surface at the completion of dredging to -51 ft MLLW as well as to characterize the sediment surface following the contingency dredging. This recontamination monitoring plan is intended to characterize surface sediment chemistry throughout the removal area, assess the thickness of the sand layer, and assess any changes in surface chemistry or sand layer thickness over time. This information will be used in the RI/FS planned for East Waterway.

2.2.1 Scope of recontamination monitoring

The recontamination monitoring plan (RMP) was developed to assess the quality of the new sediment surface after the removal of existing contaminated surface sediment to a depth of at least -51 ft MLLW and the placement of cover material within the dredge area. Data collected for the RMP will be used for the following purposes:

- To evaluate continued compliance with the cleanup standards identified in the Phase 1 Removal Action EE/CA. The cleanup standard defined in the EE/CA is the attainment of the numeric sediment quality standards (SQS) chemical concentrations at the point of compliance (0-10 cm surface sediments) for the following chemicals: total DDTs, total polychlorinated biphenyls (PCBs), and mercury. The chemical concentrations in the newly exposed surface sediments will also be less than the SQS (as measured by chemical or biological toxicity testing) for all other chemicals.
- To assess the thickness of the sand layer.
- To provide data for the RI/FS planned for East Waterway.

Cleanup objectives

- The chemical concentrations in sediment samples will be compared to the Washington State Sediment Management Standards (SMS) SQS and SMS Cleanup Screening Level (CSL) for all chemicals. If SQS and CSL values are not available Dredged Material Management Program (DMMP) screening levels and maximum levels (SLs and MLs) will be used (i.e. total DDT, dieldrin, aldrin, alpha-chlordane, heptachlor, and gamma BHC) (Table 2-4). The chemical concentrations in the newly exposed surface sediments will be less than the SQS for the following chemicals: total DDTs, total PCBs, and mercury. The chemical concentrations in the newly exposed surface sediments will also be less than the SQS (as measured by chemical or biological toxicity testing) for all other chemicals. The new sediment surface will be further evaluated as part of the RI/FS evaluation of East Waterway. Future evaluations of the area will include both chemical and biological testing.

2.2.2 Previous investigations

The post-dredge monitoring of the new sediment surface in the EWW OU Phase 1 Removal area was conducted in accordance with the post-dredge monitoring QAPP, Appendix B (Windward 2003a). The results of the initial sampling were compared to SQOs to identify the area that required further contingency dredging.

This section presents a summary of the results of the post-dredge monitoring which includes sampling conducted following the completion of the Phase 1 removal action as well as sampling conducted after the contingency dredging. The complete sediment chemistry dataset from both of these sampling events is presented in Appendix A. The results of the post-dredge sampling are summarized in Table 2-1. All of the PDM samples were analyzed for metals, mercury, semivolatile organic compounds (SVOCs), PCBs, pesticides. A subset of samples were analyzed for porewater tributyltin (TBT) concentrations. Locations and chemicals that are bolded represent areas that were identified for contingency dredging following consultation with EPA and the chemicals that triggered the identification. The chemicals most commonly detected at concentrations above the CSL were PCBs and mercury.

Table 2-1. PDM results that exceeded the corresponding SQS and CSL

Monitoring Location	Chemicals > SQS	Chemicals > CSL
1	PCBs	
2	PCBs, dieldrin[a]	
3	PCBs, total DDTs[a], dieldrin[a], hexachlorobenzene[a]	
4	1,4-Dichlorobenzene, PCBs, hexachlorobenzene[a], DDTs[a], dieldrin[a]	1,2,4-Trichlorobenzene, 2,4-dimethylphenol[a]
5	PCBs, dieldrin[a], 1,2,4-trichlorobenzene[a]	
6	Hexachlorobenzene[a], dieldrin[a]	PCBs, 1,2-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], DDTs[a]
7	1,4-Dichlorobenzene, Acenaphthene, Dibenzofuran, Fluorene, PCBs, Phenanthrene, hexachlorobenzene[a], DDTs[a], dieldrin[a]	2,4-dimethylphenol[a]
8	Hexachlorobenzene[a], DDTs[a], dieldrin[a]	Mercury, PCBs 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,2,4-trichlorobenzene[a]
9	Mercury, PCBs, hexachlorobenzene[a], DDTs[a], dieldrin[a]	2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a]
10	PCBs, total DDTs[a], dieldrin[a]	Mercury, 1,2,4-trichlorobenzene[a], 2,4-dimethylphenol[a]
11[b]	PCBs, hexachlorobenzene[a], DDTs[a], dieldrin[a]	2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,2,4-trichlorobenzene[a]
12	PCBs, hexachlorobenzene[a], DDTs[a], dieldrin[a]	2,4-dimethylphenol[a]
13	PCBs, hexachlorobenzene[a], DDTs[a], 1,2,4-trichlorobenzene[a]	2,4-dimethylphenol[a]
14	PCBs, total DDTs[a], dieldrin[a]	2,4-dimethylphenol[a]
15	PCBs, hexachlorobenzene[a], total DDTs[a]	2,4-dimethylphenol[a]

MONITORING LOCATION	CHEMICALS > SQS	CHEMICALS > CSL
16	Bis(2-ethylhexyl)phthalate, PCBs, hexachlorobenzene[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	2,4-dimethylphenol[a], 2-methylphenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
17	1,4-Dichlorobenzene, PCBs , hexachlorobenzene[a], total DDTs[a], dieldrin[a]	2,4-dimethylphenol[a]
18	1,4-Dichlorobenzene, hexachlorobenzene[a], total DDTs[a], dieldrin[a]	PCBs, 2,4-dimethylphenol[a]
19	Acenaphthene, Dibenzofuran, Fluorene, Phenanthrene, hexachlorobenzene[a], aldrin[a], dieldrin[a], gamma-BHC[a], alpha-chlordane[a], heptachlor[a]	1,2,4-Trichlorobenzene, 1,4-Dichlorobenzene, Mercury, PCBs, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], total DDTs[a]
20	1,4-Dichlorobenzene, Acenaphthene, Dibenzofuran, Fluorene, Mercury, Phenanthrene , total DDTs[a], hexachlorobenzene[a], aldrin[a], dieldrin[a], gamma-BHC[a], alpha-chlordane[a], heptachlor[a]	1,2,4-Trichlorobenzene, PCBs, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a]
21	total DDTs[a], aldrin[a], dieldrin[a], gamma-BHC[a], alpha-chlordane[a], heptachlor[a]	1,2,4-Trichlorobenzene, 1,4-Dichlorobenzene, PCBs, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], hexachlorobenzene[a]
22	1,4-Dichlorobenzene, hexachlorobenzene[a], total DDTs[a], dieldrin[a]	1,2,4-Trichlorobenzene, PCBs, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a]
23	Acenaphthene, Bis(2-ethylhexyl)phthalate, Mercury, 1,3-Dichlorobenzene, DDTs[a], dieldrin[a]	1,2,4-Trichlorobenzene, 1,4-Dichlorobenzene, PCBs
24	DDTs[a], dieldrin[a]	1,2,4-Trichlorobenzene, 1,4-Dichlorobenzene, Mercury, PCBs, 2,4-dimethylphenol[a]
25	1,4-Dichlorobenzene, PCBs, 1,2,4-trichlorobenzene	Mercury, 2,4-dimethylphenol[a]
26	1,4-Dichlorobenzene, Zinc, 1,2,4-trichlorobenzene, benzyl alcohol[a], total DDTs[a], dieldrin[a]	Mercury, PCBs, 2,4-dimethylphenol[a]
27	1,4-Dichlorobenzene, hexachlorobenzene[a], total DDTs[a], dieldrin	Mercury, PCBs, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a]
28	PCBs, 1,4-dichlorobenzene[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	Mercury, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
29	PCBs, hexachlorobenzene[a], dieldrin[a], butyl benzyl phthalate[a]	Bis(2-ethylhexyl)phthalate, Mercury, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,4-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a], total DDTs[a]
30	Mercury, PCBs, hexachlorobenzene[a], pentachlorophenol[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,4-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a]

Monitoring Location	Chemicals > SQS	Chemicals > CSL
31	Hexachlorobenzene[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	Bis(2-ethylhexyl)phthalate, Mercury, PCBs, 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,4-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
32	Bis(2-ethylhexyl)phthalate, Mercury, total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	PCBs 2,4-dimethylphenol[a], 1,2-dichlorobenzene[a], 1,4-dichlorobenzene[a], 1,2,4-trichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a], nitrosodiphenylamine[a]
33	PCBs, dieldrin[a]	Mercury, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a]
34	DDTs, dieldrin[a]	Mercury, PCBs, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a]
35	Mercury, PCBs, dieldrin[a]	2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a]
36	1,3-dichlorobenzene[a] , 1,4-dichlorobenzene[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	Mercury, PCBs, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a], 1,2-dichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
37[a]	Bis(2-ethylhexyl)phthalate, PCBs, 1,3-dichlorobenzene[a] , 1,4-dichlorobenzene[a], total DDTs[a], dieldrin[a], butyl benzyl phthalate[a]	Mercury, PCBs , 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a], 1,2-dichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
38	Mercury, 1,4-dichlorobenzene[a], pentachlorophenol[a], butyl benzyl phthalate[a]	2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a], 1,2-dichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a]
39	DDTs, 1,2,4-trichlorobenzene[a], dieldrin[a]	Bis(2-ethylhexyl)phthalate, Mercury, PCBs, 2,4-dimethylphenol[a]
40[a]	PCBs, 1,2,4-trichlorobenzene[a], dieldrin[a], DDTs[a]	Mercury, dieldrin[a], DDTs[a], 2,4-dimethylphenol[a]
41	Bis(2-ethylhexyl)phthalate, PCBs, dieldrin[a], DDTs[a]	Mercury,1,2,4-trichlorobenzene[a], 2,4-dimethylphenol[a]
42	Mercury, PCBs	1,2,4-trichlorobenzene[a], 2,4-dimethylphenol[a]
43	Bis(2-ethylhexyl)phthalate, 1,4-dichlorobenzene[a], hexachlorobenzene[a], butyl benzyl phthalate[a], dieldrin[a]	Mercury, PCBs, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a], 1,2-dichlorobenzene[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a], DDTs[a]

MONITORING LOCATION	CHEMICALS > SQS	CHEMICALS > CSL
44	Bis(2-ethylhexyl)phthalate, total DDTs[a], aldrin[a], dieldrin[a], gamma-BHC[a], alpha-chlordane[a], heptachlor[a], hexachlorobenzene[a], butyl benzyl phthalate[a]	Mercury, PCBs, 2,4-dimethylphenol[a], 1,2,4-trichlorobenzene[a], 1,2-dichlorobenzene[a], 1,4-dichlorobenzene[a] 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], pentachlorophenol[a]
45[c]	1,4-Dichlorobenzene, Bis(2-ethylhexyl)phthalate, Zinc, dieldrin[a], DDTs[a], 1,2,4-trichlorobenzene[a]	Mercury, PCBs, 2,4-dimethylphenol[a]
46[c]	PCBs, dieldrin[a], DDTs[a], 1,2,4-trichlorobenzene[a]	Mercury, 2,4-dimethylphenol[a]
47[c]	1,4-Dichlorobenzene, Bis(2-ethylhexyl)phthalate, Zinc, dieldrin[a], DDTs[a], 1,2,4-trichlorobenzene[a]	Mercury, PCBs, 2,4-dimethylphenol[a]

[a] Chemical was nondetected with an RL above the corresponding SQS or CSL

[b] EPA discretionary sample also sampled in this area. Summary includes results from both samples.

[c] Sample located on the mound and contingency dredging not necessary, cover material was placed.

Shading: Areas that were identified for contingency dredging following consultation with the EPA.

Following contingency dredging, the areas that were subject to dredging were resampled in pre-sand placement sampling. The results are summarized in Table 2-2. In general, there are fewer CSL exceedances in pre-sand placement samples than there were in the initial PDM samples. It is important to note that all of these samples represent areas that were subsequently covered with a 6-12 inch layer of clean sand material.

Table 2-2. Results of the pre-sand placement sample compared to SQS/CSL

POST-PDM LOCATION	DETECTED CHEMICALS > SQS	DETECTED CHEMICAL >CSL
4[b]	1,3-dichlorobenzene	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, PCBs
6[c]	PCBs, 1,2,4-trichlorobenzene[a]	
7[d]	fluoranthene, total HPAH, butyl benzyl phthalate[a], hexachlorobutadiene[a], pentachlorophenol[a]	mercury, acenaphthene, dibenzofuran, fluorene, phenanthrene, total LPAH, bis(2-ethylhexyl)phthalate, PCBs, 2,4-dimethyl phenol[a], 2-methyl phenol[a], benzoic acid[a], benzyl alcohol[a], hexachlorobenzene[a]
8[c]	mercury, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene	PCBs
14[c]	mercury, PCBs	
15[b]	mercury, PCBs	
16[c]	mercury, PCBs	
18[b]	PCBs	
19[e]	PCBs, hexachlorobenzene[a]	
20[d]	acenaphthene, fluorene, PCBs, hexachlorobenzene[a]	
21[b]	1,4-dichlorobenzene, PCBs	1,2,4-trichlorobenzene
22[c]		mercury, PCBs
23[d]	1,2,4-trichlorobenzene,	PCBs

Post-PDM Location	Detected Chemicals > SQS	Detected Chemical >CSL
	1,4-dichlorobenzene, hexachlorobenzene[a]	
24[b]	1,2,4-trichlorobenzene, PCBs	mercury
25[b]	PCBs	mercury
26[f]	mercury, PCBs	
27[b]	PCBs	mercury
28[b]	mercury, PCBs	
29[e]	mercury, PCBs, hexachlorobenzene[a]	
30[b]	mercury, PCBs	
31[d]	PCBs, hexachlorobenzene[a]	mercury
32[d]	mercury, 1,2,4-trichlorobenzene, PCBs, hexachlorobenzene[a]	
33[c]	mercury, PCBs	
34[g]	PCBs	
35[b]	PCBs	
36[c]	PCBs	1,2,4-trichlorobenzene
37[d]	mercury, PCBs, hexachlorobenzene[a]	
38[c]	mercury	
39[h]	mercury, PCBs, DDTs[a], dieldrin[a]	
40[b]	mercury, 1,2,4-trichlorobenzene, PCBs	
41[e]	PCBs, hexachlorobenzene[a]	mercury
42[b]	mercury, PCBs	
43[d]	hexachlorobenzene[a]	mercury
44[e]	PCBs, hexachlorobenzene[a]	mercury

a Chemical not detected with a reporting limit above the SQS or CSL

b Analyzed for PCBs, mercury, chlorobenzenes

c Analyzed for PCBs, mercury, chlorobenzenes, and TBT (porewater)

d Analyzed for PCBs, mercury, chlorobenzenes, and SVOCs

e Analyzed for PCBs, mercury, chlorobenzenes, TBT (porewater) and SVOCs

f Analyzed for PCBs, mercury, chlorobenzenes, TBT (porewater) and metals

g Analyzed for PCBs, mercury, chlorobenzenes, and pesticides

h Analyzed for PCBs, mercury, chlorobenzenes, pesticides, and SVOCs

2.3 Project/Task Description and Schedule

Recontamination monitoring will begin in January 2006 and will be conducted yearly in 2007 and 2008. In 2008, the project will be assessed in terms of the results of the EW RI/FS and the status of site-wide monitoring efforts. At this time, stations with consistent SQS exceedances may be proposed for bioassay testing. A bioassay testing QAPP addendum will be prepared if necessary. At that time, it is possible that the goals of the recontamination monitoring plan can be achieved through a site-wide RI/FS. In addition, the sampling frequency will be evaluated at that time to determine whether or not annual monitoring will continue to be necessary. The results of the recontamination monitoring which will include physical measurement of the depth of cover material as well as chemical measurements of sediment chemical concentrations will be presented in a data report produced at the completion of each yearly monitoring event.

2.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall DQO for this project is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. Table 2-3 lists specific data quality objectives for the chemical analyses. The laboratory reporting limits for each analyte are compared to the SQS/SL values in Attachment B. All of the reporting limits are below the corresponding SQS values except for the chlorobenzene compounds. The comparison was based on the lowest total organic carbon (TOC) concentration that is permissible for OC normalization (0.5%) and therefore represents the worst case for these compounds. If RL values are reported above the SQS for these compounds, SIM analysis will be performed in order to achieve lower RLs. Matrix interferences between individual chemicals or chemical groups in individual samples may result in an increase in the reported detection limits. To achieve the required low detection limits, some modifications to the methods may be necessary. The lab may determine that additional clean-up techniques such as sulfur removal, gel permeation chromatography, and florisil cleanups are necessary and will be employed at their discretion.

The chemical and physical testing will adhere to the most recent PSEP QA/QC procedures (PSEP 1997b) and PSEP analysis protocols. PCBs, DDTs, and mercury will be analyzed according to the guidelines provided in PSEP (1997c). EPA Method 9060 (EPA 1986) will be used for the analysis of TOC because the analytical method for TOC in PSEP (1986) is now out of date.

The parameters used to assess data quality are precision, accuracy, representativeness, comparability, and completeness. These parameters are discussed in the following sections.

Table 2-3. Summary of data quality objectives

Parameter	Units	Reporting Limits	Precision	Accuracy	Completeness	Method	Sample Holding Time	Preservative
Semivolatile organic compounds	µg/kg dw	20	±30%	10 – 177%	100%	GC/MS (EPA 8270)	14 days[a]	Cool/4°C
Selected SVOC[b]	µg//kg dw	0.0067 – 0.033	±30%	10 – 177%	100%	GC/MS (EPA 8270-SIM)	14 days[a]	Cool/4°C
Mercury	mg/kg dw	0.02	±20%	75 – 125%	100%	CVAA (EPA 7471)	28 days	Cool/4°C
Other metals[c]	mg/kg dw	1.0	±20%	75 – 125%	100%	ICP (EPA 6010)	1 year	Cool/4°C
Organochlorine pesticides[d]	µg/kg dw	6.0	±30%	30 – 160%	100%	GC/ECD (EPA 8081)	14 days[a]	Cool/4°C
Polychlorinated biphenyls (PCBs)	µg/kg dw	30	±30%	30 – 160%	100%	GC/ECD (EPA 8082)	14 days[a]	Cool/4°C
Grain size	percent dw	na	na	30%	100%	Sieve/pipette (PSEP)	6 months	Cool/4°C
TOC	percent dw	0.01	±20%	75 – 125%	100%	Combustion (EPA 9060)	28 days	Cool/4°C

[a] Sample can be refrigerated 14 days until extraction, 40 days to analysis from time of extraction. Extracts will be preserved frozen for 6 months. Sample can be frozen for a year prior to extraction.

[b] Selected SVOCs include: 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol,2-methylphenol, benzoic acid, benzyl alcohol, butyl benzyl phthalate, diethyl phthalate, dimethyl phthalate, hexachlorobenzene, hexachlorobutadiene, n-nitrosodimethylamine, n-nitrosodiphenylamine, n-nitrosodi-n-propylamine, and pentachlorophenol

[c] Other metals include antimony, arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc

[d] Target pesticides include all standard 8081 analytes: 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, 2,4'-DDT, 2,4'-DDE, 2,4'-DDD, aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, oxychlordane, alpha- and gamma-chlordane, cis- and trans-nonachlor, dieldrin, endosulfan, endosulfan sulfate, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, methoxychlor, mirex, and toxaphene

dw – dry weight

CVAA – Cold vapor atomic absorption

ECD – electron capture detection

GC – gas chromatography

na – not applicable

TOC - total organic carbon

2.4.1 Precision

Precision is the measure of the reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample and is expressed as a relative percent difference (RPD) when duplicate analyses are performed and as a percent relative standard deviation (%RSD) when more than two analyses are performed on the same sample (i.e., triplicates). Precision is assessed by duplicate analyses for all parameters except when reference materials are not available or spiking of the matrix is inappropriate; in these cases, precision is assessed by triplicate analyses. Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as either %RSD or RPD) increases. The equations used to express precision are as follows:

$$\text{RPD} = \frac{\text{measured value} - \text{measured duplicate value}}{(\text{measured value} + \text{measured duplicate value}) \div 2} \times 100$$

$$\%\text{RSD} = (\text{SD}/\text{D}_{\text{ave}}) \times 100$$

Where:

$$\text{SD} = \sqrt{\left(\frac{\sum (\text{D}_n - \text{D}_{\text{ave}})^2}{(n-1)}\right)}$$

D	=	sample value
D_{ave}	=	average sample value
n	=	number of samples

2.4.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as the percent difference between two measured values, as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equations used to express accuracy are as follows:

$$\text{Percent difference} = \frac{\text{measured value} - \text{true value}}{\text{true value}} \times 100$$

For reference materials:

$$\text{Percent of true value} = \frac{\text{measured value}}{\text{true value}} \times 100$$

For spiked samples:

$$\text{Percent recovery} = \frac{\text{spike sample result} - \text{unspiked sample result}}{\text{amount of spike added}} \times 100$$

2.4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For this project, the substances selected for analysis have been identified as the potential hazardous substances related to the site.

2.4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this investigation, comparability of data will be established through the use of project-defined general methods and reporting formats and the use of common, traceable calibration and reference materials from the National Institute of Standards and Technology or other established sources.

2.4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \text{ x } 100$$

The DQO for completeness for all components of this project is 90%. Data that have been qualified as estimated because the quality control criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

2.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. The 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safety and with minimum risk to their personal health. All sampling personnel will have completed the 40-hr Hazwoper training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations

2.6 DOCUMENTATION AND RECORDS

2.6.1 Field observations

All field activities will be recorded in a field logbook maintained by the FC. The field logbook will provide a description of all sampling activities, conferences associated with field sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified this QAPP and the HSP (Attachment A). The field logbook will consist of bound, numbered pages. All entries will be made in indelible ink. The field logbook is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

After sediment sample collection, the following information will be recorded on the sediment collection sheets (Form 1).

- Date and time of collection or logging and name of person logging sample
- Names of crew members
- Weather conditions
- Station ID number
- Station location
- Project designation
- Depth of water at the location
- Physical observations of sediments, including presence of cover material, foreign objects, color, presence of sheens, apparent grain size, and odor
- Penetration depth of the sampler

2.6.2 Analytical chemistry records

Laboratories will be responsible for internal checks on data reporting and will correct errors identified during the QA review. All laboratories must be accredited by both state and federal standards for the required sediment chemistry analytical methods. Close contact will be maintained with the laboratories to resolve any quality control problems in a timely manner. The laboratories will be required to report the following:

- ***Project narrative***: This summary, in the form of a cover letter, will present any problems encountered during any aspect of analysis. The summary will include, but not be limited to, discussion of quality control, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in detail.
- ***Records***: Legible copies of the chain-of-custody (COC) forms will be provided as part of the data package. This documentation will include the time of receipt and the condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- ***Sample results***: The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:

- Field sample identification code and the corresponding laboratory identification code
- Sample matrix
- Date of sample extraction / digestion
- Date and time of analysis
- Weight and / or volume used for analysis
- Final dilution volumes or concentration factor for the sample
- Percent moisture in the samples
- Identification of the instruments used for analysis
- Method detection, reporting and quantitation limits
- PCB concentrations for each Aroclor reported to appropriate significant figures with reporting units identified
- All data qualifiers and their definitions
- A computer diskette containing all of the data

- ***QA/QC summaries***: This section will contain the results of all QA / QC procedures. Each QA / QC sample analysis will be documented with the same information required for the sample results (see above). The laboratory will make no recovery or blank corrections. The required summaries are listed below; additional information may be requested.
  - **Calibration data summary**: Report the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. List the response factor, %RSD, percent difference, and retention time for each analyte as appropriate. Report results for standards to indicate instrument sensitivity.
  - **Internal standard area summary:** Report the internal standard retention times and areas as appropriate.
  - **Method blank analysis:** Report the method blank analysis associated with each sample and the concentration of all compounds of interest identified in these blanks.
  - **Surrogate spike recovery:** Report all surrogate spike recovery data for organic analyses. List the name and concentration of all compounds added, percent recoveries, and QC limits.
  - **Matrix spike recovery:** Report the matrix spike recovery data for analyses, as appropriate. List the name and concentration of all compounds added, percent recoveries, and QC limits. Report the relative percent difference for all matrix spike and matrix spike duplicate analyses.

- **Matrix duplicate:** Report the RPD for all matrix duplicate analyses. List the quality control limits for each compound or analyte.
- **Relative retention time:** Report the relative retention times for the primary and confirmational columns of each analyte detected in the samples as appropriate.

- **Original data:** Legible copies of the original data generated by the laboratory will be provided, including the following:
  - Sample refrigerator temperature logs
  - Sample extraction / digestion, preparation, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Unenhanced (raw) and enhanced spectra of detected compounds with associated best-match spectra for each sample
  - Printouts and quantitation reports for each instrument used, including reports for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Original data quantification reports for each sample
  - Original data for blanks and samples not reported

All contract laboratories for this project will submit data both in hard copy and in electronic format. Guidelines for electronic data deliverables for chemistry data are as follows:

- Each row of data should contain only one analyte for a given sample. Therefore, one complete sample will require multiple rows.
- Each row should contain the following information at a minimum: Windward sample identifier, sample matrix, laboratory sample identifier (if used), date of sampling, date of laboratory analysis, laboratory method, analyte name, measured result, laboratory qualifiers, units, and measurement basis.
- If using a spreadsheet file to produce the electronic deliverable, the value representing the measured concentration or detection limit should not only be formatted to show the correct number of significant figures but should not contain any trailing digits that are hidden in the formatting.
- If using a database program to produce the electronic deliverable, the value representing the measured concentration or detection limit should be stored in a character field, or a field in addition to the numeric result field should be provided to define the correct number of significant figures.

- If a result for an analyte is below the detection limit, the laboratory qualifier should be U, and the value in the result column should be the sample-specific detection limit.
- Laboratory samples for QA/QC should be included and clearly identified in the file with unique laboratory sample identifiers. Additional columns may be used to distinguish the sample type (e.g., matrix spike, matrix spike duplicate).
- If replicate analyses are conducted on a submitted field sample, the laboratory sample identifier must distinguish among the replicates.
- Wherever possible, all analytes and replicates for a given sample should be grouped together.

An example of the acceptable electronic deliverable for analytical chemistry is provided in Table 2-4.

Table 2-4. Example of acceptable organization of electronic deliverable for analytical chemistry

SAMPLE	LAB ID	MATRIX	COLLECTION DATE	ANALYSIS DATE	ANALYTE	METHOD	RESULT	QUALIFIERS	UNITS	MEASUREMENT BASIS
A1	AL1234	sed.	07/16/97	07/22/97	Total solids	EPA 160.3	19.6		percent	wet weight
A1	AL1234	sed.	07/16/97	07/22/97	Percent moisture	calculated	81.3		percent	wet weight
A5	AL1235	sed.	07/15/97	07/22/97	Total solids	EPA 160.3	17.4		percent	wet weight
A5	AL1235	sed.	07/15/97	07/22/97	Percent moisture	calculated	83.2		percent	wet weight

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines ensures that all data are consistently converted into the desired data structures and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied. Final electronic files will be made available to the Port in an agreed-upon format.

Written documentation will be used to clarify how field and laboratory duplicates and QA/QC samples were recorded in the data tables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that study team members who use the data will have appropriate documentation.

In addition to placing all data and identifiers in an electronic database, hard copies of all original analytical data or study records will be placed in a library filing system. Each analytical data set or document will be given a unique code based on the original source of the data or information and filed based on that code. A master list of all filed documents, sorted in order by filing code, will be maintained for easy retrieval from the library. Data management files will be stored on a secure computer or on a removable hard drive that can be secured.

After the data have been validated, all original data and documentation generated by the laboratories will be kept in a secure location for ten years. COC procedures will be followed for all laboratory data and data documentation, whether in hard copy or electronic format. All laboratory data and data documentation, including electronic data files, will be submitted to the Project QA / QC Coordinator for validation.

2.6.3 Data reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the Laboratory Project Manager, the Project Manager, the Project QA / QC Coordinator, and independent reviewers. Sediment results will be reported on a dry-weight basis, with percent moisture noted. The data will be generated in a form amenable to review and evaluation. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

2.6.4 Data report

A data report will be prepared documenting all activities associated with the collection, handling, and analysis of samples. At a minimum, the following will be included in the data report:

- Summary of all field activities, including descriptions of any deviations from the approved QAPP
- Locations of sediment sampling locations reported in latitude and longitude to the nearest one-tenth of a second and in northing and easting to the nearest foot
- Plan view of the project showing the actual sampling locations
- A summary of the QA / QC review of the analytical data
- The results from the analysis of field samples
- Comparison of chemistry results to applicable SMS standards or DMMP guidelines, and area-wide averages and 95UCL as necessary (Table 2-5)

The chemistry data will be provided in an electronic format that is fully compatible with the Department of Ecology's SEDQUAL database.

Data will be validated within four weeks of receiving data packages from the respective laboratories. A draft data report will be submitted four weeks after receipt of the validated analytical and biological results. A final data report will be submitted three weeks after receiving comments on the draft report.

Table 2-5. Regulatory standards or guidelines for chemicals of interest

Analyte	SQS[a]	CSL[a]
Total PCBs	12 mg/kg OC	65 mg/kg OC
Total DDTs [b]	6.9 µg/kg	69 µg/kg
Dieldrin[b]	10 µg/kg	na
Aldrin[b]	10 µg/kg	na
alpha-Chlordane	10 µg/kg	na
Heptachlor	10 µg/kg	na
gamma-BHC	10 µg/kg	na
Antimony[b]	150 mg/kg	200 mg/kg
Arsenic	57 mg/kg	93 mg/kg
Cadmium	5.1 mg/kg	6.7 mg/kg
Chromium	260 mg/kg	270 mg/kg
Copper	390 mg/kg	390 mg/kg
Lead	450 mg/kg	530 mg/kg
Mercury	0.41 mg/kg	0.59 mg/kg
Nickel[b]	140 mg/kg	370 mg/kg
Silver	6.1 mg/kg	6.1 mg/kg
Zinc	410 mg/kg	960 mg/kg
LPAH	370 mg/kg OC	780 mg/kg OC
HPAH	960 mg/kg OC	5,300 mg/kg OC
Naphthalene	99 mg/kg OC	170 mg/kg OC
2-Methylnaphthalene	38 mg/kg OC	64 mg/kg OC
Acenaphthylene	66 mg/kg OC	66 mg/kg OC
Acenaphthene	16 mg/kg OC	57 mg/kg OC
Fluorene	23 mg/kg OC	79 mg/kg OC
Phenanthrene	100 mg/kg OC	480 mg/kg OC
Anthracene	220 mg/kg OC	1,200 mg/kg OC
Fluoranthene	160 mg/kg OC	1,200 mg/kg OC
Pyrene	1,000 mg/kg OC	1,400 mg/kg OC
Benz(a)anthracene	110 mg/kg OC	270 mg/kg OC
Chrysene	110 mg/kg OC	460 mg/kg OC
Benzo(b+k)fluoranthene	230 mg/kg OC	450 mg/kg OC
Benzo(a)pyrene	99 mg/kg OC	210 mg/kg OC
Indeno(1,2,3-cd)pyrene	34 mg/kg OC	88 mg/kg OC
Dibenz(a,h)anthracene	12 mg/kg OC	33 mg/kg OC
Benzo(g,h,i)perylene	31 mg/kg OC	78 mg/kg OC
1,2-Dichlorobenzene	2.3 mg/kg OC	2.3 mg/kg OC
1,4-Dichlorobenzene	3.1 mg/kg OC	9 mg/kg OC

ANALYTE	SQS[a]	CSL[a]
1,2,4-Trichlorobenzene	0.81 mg/kg OC	1.8 mg/kg OC
Hexachlorobenzene	0.38 mg/kg OC	2.3 mg/kg OC
Dimethyl phthalate	53 mg/kg OC	53 mg/kg OC
Diethyl phthalate	61 mg/kg OC	110 mg/kg OC
Di-N-butyl phthalate	220 mg/kg OC	1,700 mg/kg OC
Butyl benzyl phthalate	4.9 mg/kg OC	64 mg/kg OC
Bis(2-ethylhexyl) phthalate	47 mg/kg OC	78 mg/kg OC
Di-N-octyl phthalate	58 mg/kg OC	4,500 mg/kg OC
Dibenzofuran	15 mg/kg OC	58 mg/kg OC
Hexachlorobutadiene	3.9 mg/kg OC	6.2 mg/kg OC
N-nitrosodiphenylamine	11 mg/kg OC	11 mg/kg OC
Phenol	420 µg/kg	1,200 µg/kg
2-Methylphenol	63 µg/kg	63 µg/kg
4-Methylphenol	670 µg/kg	670 µg/kg
2,4-Dimethylphenol	29 µg/kg	29 µg/kg
Pentachlorophenol	360 µg/kg	690 µg/kg
Benzyl alcohol	57 µg/kg	73 µg/kg
Benzoic acid	650 µg/kg	650 µg/kg

na – not available

OC - organic carbon-normalized

[a] SMS standards (SQS=Sediment Quality Standards, CSL=Cleanup Screening Level)

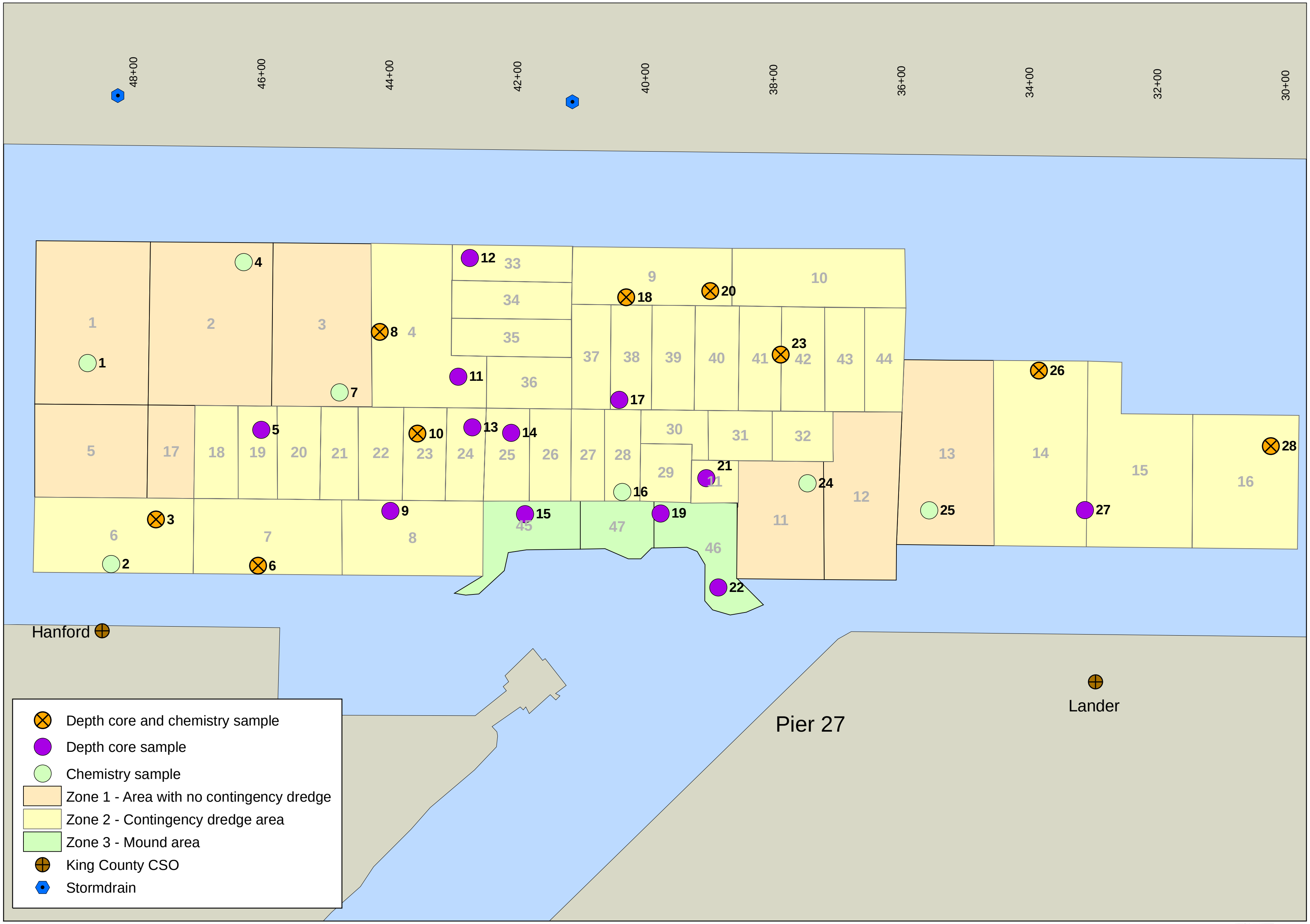
[b] DMMP guidelines (SL=Screening Level, ML=Maximum Level) (PSDDA 1996) when SMS standards not available

3.0 Data Generation and Acquisition

3.1 SAMPLING PROCESS DESIGN

The completion of the Phase 1 Removal Action resulted in the three distinct sediment types. The three sediment types have been characterized as Zone 1, Zone 2 and Zone 3 in Map 1. Zone 1 sediments are sediments in areas that were not subjected to any additional dredging following the completion of the Removal Action and these sediments were not covered with cover material. Zone 2 sediments are sediments in areas that were subject to contingency dredging and subsequent placement of cover material. Finally, Zone 3 sediments are located on the slope of the mound area.

No contingency dredging was conducted on the slope of the mound but, cover material was placed on the mound following the Removal Action.



Map 1. East Waterway proposed depth core and chemistry sample locations

0 50 Meters

0 200 Feet

WindWard environmental LLC

Prepared by STS 08/25/05 (Source 1869), revised 09/29/05 KH Map 1957

W:\Projects\00-08-08 East Waterway\Data\GIS\PDM

Each sediment zone has unique sampling requirements. Zone 1 sediments will be sampled to confirm sediment chemical concentrations measured previously. Core samples will be collected in Zone 2 to confirm the depth of the sand cover layer. Surface sediment (0-10 cm) samples will be collected with a grab sampler and analyzed to determine sediment chemical concentrations. The mound cover material in Zone 3 is likely to be difficult to sample using sediment cores due to grain size of the cover material. Therefore, sediment grab samples will be collected in Zone 3 in order to confirm the depth of the cover material as well as to confirm sediment chemical concentrations. A summary of the number of samples and analyses proposed for each zone is provided in Table 3-1. Proposed sample locations are provided in Map 1 and Table 3-2.

Table 3-1. Number of samples and analyses for each sediment zone

Zone	Number of Samples	Sample Type	Analytes
Zone 1	5 chemistry	grab sample	SMS suite
Zone 2	11 chemistry	grab sample	SMS suite
	18 cover verification	core sample	cover depth
Zone 3	3 cover verification	grab sample	cover depth

Table 3-2. Location and sample IDs

Sample Number	PDM Sampling Area	Easting	Northing	Sample Type
1	1	1267413	214188	chemistry
2	6	1267726	214222	chemistry
3	6	1267657	214293	core and chemistry
4	2	1267258	214434	chemistry
5	19	1267519	214458	core
6	7	1267730	214452	core and chemistry
7	3	1267462	214581	chemistry
8	4	1267368	214645	core and chemistry
9	8	1267647	214659	core
10	23	1267527	214703	core and chemistry
11	4	1267439	214767	core
12	33	1267254	214787	core
13	24	1267518	214788	core
14	25	1267527	214849	core
15	45	1267653	214869	core
16	28	1267620	215021	chemistry
17	38	1267477	215018	core
18	9	1267317	215030	core and chemistry

SAMPLE NUMBER	PDM SAMPLING AREA	EASTING	NORTHING	SAMPLE TYPE
19	46	1267654	215081	core
20	9	1267308	215161	core and chemistry
21	11	1267600	215153	core
22	46	1267770	215171	core
23	41/42	1267408	215271	core and chemistry
24	11	1267609	215311	chemistry
25	13	1267653	215501	chemistry
26	14	1267436	215674	core and chemistry
27	14/15	1267654	215744	core
28	16	1267557	216035	core and chemistry

Datum – Washington State Plane North, NAD83, US survey ft

3.2 SAMPLING METHODS REQUIREMENTS

All field activities will be performed under the direction of the FC. Sampling will be accomplished by a joint operation of Windward and Bio-Marine Enterprises. Sampling will be conducted aboard a 25 ft Wooldridge jet boat under the direction of Mr. Charlie Eaton. The vessel will be staffed, at a minimum, with the captain, one deck hand, the FC and two field technicians. The field technicians will assist in gear deployment and retrieval, and sediment sample collection. Core and grab samples will be processed on the boat immediately after collection. The FC will log and process the samples. Once sediment samples have been collected, field personnel will fill sample containers for transport to the analytical laboratory.

3.2.1 Station and sample identification

Each location shown on Map 1 has been assigned a unique identifier. The first four characters are EW-RM, for the EWW recontamination monitoring event. The last characters are consecutive numbers between 1 and 30 to identify the specific location within the EWW (e.g., EW-RM-1). Sample identifiers will have the same identifiers as the locations but will also include the two-digit year after the event identifier. For example, a sample taken at location 1 in 2005 will be identified as “EW-RM05-1.”

Field QA/QC samples will be assigned modified sample identifiers as described below:

- Field replicates will be assigned a unique sample location number starting with 101 (e.g., EW-RM05-101).
- Rinsate blanks will be assigned the same characters as the sample identifier, followed by the identifier “RB.” For example, the rinsate blank collected for sample EW-RM05-1 would be “EW-RM05-1-RB”.

3.2.2 Field operations and sample collection equipment

The following sections provide information on vessel positioning and sampling methods for sediment collection.

Navigation and positioning

Sampling locations will be surveyed by Bio-Marine Enterprises using a differential global positioning system (DGPS). The DGPS includes a GPS receiver unit onboard the sampling vessel and a Coast Guard beacon differential receiver. The GPS unit will receive radio broadcasts of GPS signals from satellites. The Coast Guard beacon receiver will acquire corrections to the GPS signals to produce positioning accuracy to within 1-2 m.

Northing and easting coordinates of the vessel will be updated every second and displayed directly on a computer aboard the vessel. The coordinates will then be processed in real time and stored at the time of sampling using the positioning data management software package. Washington State Plane Coordinates, North (NAD 83) will be used for the horizontal datum. The vertical datum will be the National Ocean Service MLLW datum. Vertical control will be provided by the ship's depth finder and corrected for tidal influence. Tide elevation will be determined by calling the National Ocean Service (206.749.9218) for data from their automated tide gage located at Pier 54.

To ensure the accuracy of the navigation system, a checkpoint will be located at a known point such as a pier face, dock, piling, or similar structure that is accessible by the sampling vessel. At the beginning and end of each day, the vessel will be stationed at the check point, a GPS position reading will be taken, and the reading will be compared with the known land-survey coordinates. The two position readings should agree, within the limits of survey vessel operational mobility, to within 1-2 m.

An onboard computer will display the vessel's position during sampling operations. Proposed locations (Table 3-1) will have been previously stored in the vessel's computer. The proposed station location will be displayed on the area map on the computer screen, and the vessel's location will be displayed as a moving dot on that map. The range and bearing from the vessel to the proposed station location (target position) will be displayed on the screen. The scale of the grid will be magnified as the vessel nears the proposed station location. During sampling, vessel position can be monitored constantly using this computer display. Actual sample location coordinates will be determined when the sampler is on the bottom, and the cable is taut and perpendicular to the water surface.

Sediment sample collection

Sediment collection and processing will follow standardized procedures for the Puget Sound area that have been developed by PSEP (1997c).

Sediment cores will be collected using a gravity corer with a 3-inch (outer diameter) steel core tube and a butyl acetate core-tube liner. Because inertia will be utilized as the primary driving force to achieve the desired penetration depth, the degree of penetration will be altered by either adjusting the number of weights at the top of the tube or by changing the vertical distance from which the core tube is allowed to free-fall. The corer will be advanced into the sediment to refusal using enough weight to achieve the minimum target penetration depth of 80 cm. At each sample location, total water depth and total sediment recovered will be measured and recorded in the field log book. Time and date of core collection will also be recorded. Cores will be photographed through the clear liner, and the presence or absence of the sand layer, the depth of the sand layer, visible organic material, etc. of each core will be documented.

At locations that have been designated for depth core sampling only, the examination of the core may trigger the collection of a sediment chemistry grab sample at that location. If less than 10cm of sand layer is observed at a location that has been designated for a depth core, then a chemistry sample will be collected. In addition, if material is observed overlying the sand layer with a depth greater than 2cm then, a chemistry sample will be collected.

Surface sediment samples for chemical analysis will be collected from each station from the 0- to 10-cm sediment interval. If necessary composite samples will be created from multiple grab or core samples to generate enough volume for the required analyses. Approximately 1 L of sediment will be required from each station (see Table 3-2).

Surface sediment samples will be collected using a stainless steel, 0.1-m^2 van Veen grab sampler. The general procedure for collecting sediment samples using this type of grab sampler is described below:

1. Maneuver the sampling vessel to the pre-identified sampling location.
2. Open the grab sampler jaws into the deployment position.
3. Guide the sampler overboard until it is clear of the vessel.
4. Lower the sampler through the water column to the bottom at approximately 0.3 m/s.
5. Record the location of the boat when the sampler reaches bottom.
6. Signal hydraulic control operator to close the sampler jaws
7. Retrieve the sampler and raise it at approximately 0.3 m/s.
8. Guide the sampler aboard the vessel and place it on the work stand on the deck; using care to avoid jostling that might disturb the integrity of the sample.
9. Examine the sample using the following sediment acceptance criteria:
   - The sample does not contain foreign objects

- The sampler is not over-filled with sediment so that the sediment surface presses against the top of the sampler
- No leakage has occurred, as indicated by overlying water on the sediment surface
- No sample disturbance has occurred, as indicated by limited turbidity in the overlying water
- No winnowing has occurred, as indicated by a relatively flat undisturbed surface
- A penetration depth of at least 11 cm has been achieved

If these sample acceptance criteria are not achieved, the sample will be rejected. If a sample that meets the appropriate acceptance criteria cannot be obtained after three attempts within 10 m of the proposed location, the station may be relocated or deleted.

Sediment processing is described below:

1. Siphon off any standing water from the surface of the sediment using a hose primed with site water. Be careful during siphoning not to disturb the integrity of the sediment surface.
2. In Zone 3 samples, the sediment will be examined in order to determine the depth of the cover material if possible.
3. Collect the upper 10 cm of sediments from the sampler using a stainless-steel spoon. Take care not to include any material that has been in contact with any interior sampler surface. Place the sediment in a stainless-steel mixing bowl.
4. Thoroughly rinse the interior of the sampler with site water until all loose sediment has been washed off.
5. Repeat the sampling process until sufficient sediment volume is obtained from the station to satisfy the analytical requirements.
6. Homogenize the sediment using stainless-steel spoon.
7. Distribute the homogenized sediment to appropriate sample containers according to the sample requirements identified in Table 3-2, secure the container lids, and ensure that sample labels are completely and correctly filled out and affixed to the containers.
8. Clean the exterior of all sample containers and store in an ice chest at 4°C.
9. Thoroughly decontaminate the sampler and homogenization equipment by following the procedure in Section 3.2.5.
10. Ensure that all logbook and grab sample log sheet entries are complete.
11. Proceed to the next proposed sampling location.

3.2.3 Sample handling procedures

This section describes how individual sediment samples will be processed, labeled, tracked, stored, and transported to the laboratory for analysis.

Sample containers and sample labels

The analytical laboratories will provide pre-cleaned sample containers. Sediment samples will be placed in appropriate-sized, certified-clean, wide-mouth glass jars and capped with Teflon®-lined lids. All sample containers will be filled leaving a minimum of 1 cm of headspace to prevent breakage during shipping and storage. The types of sample containers to be used and sample volume for sediment are summarized in Table 3-3. Each jar will be sealed, completely labeled, and stored under appropriate conditions as outlined in Table 2-2.

Table 3-3. Sample volume required and storage containers for sediment

Parameter	Container	Laboratory
Metals, TOC	1 4-oz glass jar	ARI
Total PCBs, semi-volatile organics, pesticides	1 16-oz glass jar[a]	ARI
Grain size	1 16-oz glass jar	ARI

[a] A single container will be used for these analyses. Remainder of the sample will be archived frozen at ARI.

Sample labels will be waterproof and self-adhering. Each sample label will contain the project number, sample identification, preservation technique, analyses, date and time of collection, and initials of the person(s) preparing the sample. A completed sample label will be affixed to each sample container. The labels will be covered with clear tape immediately after they have been completed to protect them from water and sediment.

Sampling contingencies

There may be contingencies during field activities that require modification of the general procedures outlined above. Modification of procedures will be at the discretion of the FC after consultation with the Project Manager and the boat operator. The Port and EPA will be notified in the event that significant deviations from the sampling plan are required. Sampling contingencies, modifications, and deviations from the QAPP will be document using the Protocol Modification Form (Form 2).

3.2.5 Decontamination procedures

All sediment homogenizing equipment, which includes the mixing bowl and stainless-steel implements, will be decontaminated between locations using the following procedures:

1. Rinse with site water and wash with scrub brush until free of sediment.
2. Wash with phosphate-free detergent.

3. Rinse with site water.
4. Rinse with distilled water.

The grab sampler will also be decontaminated between locations by following steps 1 through 4 listed above.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity. Specifically:

- The use of acids or organic solvents may pose a safety hazard to the crew.
- Disposal and spillage of acids and solvents during field activities pose an environmental concern.
- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing.

Any sampling equipment that cannot be cleaned to the satisfaction of the FC will not be used for any further sampling activity.

3.2.6. Field-generated waste disposal

Excess sediment remaining after all sampling is completed will be returned to the collection site. All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste.

3.3 Sample Handling and Custody

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are ready to be introduced as evidence. This section describes the minimum project requirements for sample handling and custody procedures.

3.3.1 Sample custody procedures

Samples are considered to be in custody if they are 1) in the custodian's possession or view, 2) retained in a secured place (under lock) with restricted access, or 3) placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Custody procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation whether in hard copy or electronic format. Custody procedures will be initiated during sediment sample collection. A COC form will accompany samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include:

- Sample location, project name, and unique sample number
- Sample collection date and time
- Any special notations on sample characteristics or problems
- Initials of the person collecting the sample
- Date sample was sent to the laboratory
- Shipping company name and waybill number

The Laboratory Project Managers at each laboratory will ensure that COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratories will contact the Project QA/QC Coordinator immediately if discrepancies are discovered between the COC forms and the sample shipment upon receipt. The temperature inside the cooler(s) will be checked upon receipt of the samples. The Laboratory Project Manager will specifically note any coolers that do not contain ice packs or that are not sufficiently cold (4 ± 2°C) upon receipt. Each sample will be assigned a unique laboratory number, and samples will be grouped in appropriate sample delivery groups.

All samples will be handled so as to prevent contamination or loss of any sample. Samples will be assigned a specific storage area within the laboratory and will be kept there until analyzed.

The Laboratory Project Manager will ensure that a sample-tracking record follows each sample through all stages of laboratory processing. The sample-tracking record must contain, at a minimum, the name/initials of responsible individuals performing the analyses, dates of sample extraction/preparation and analysis, and the type of analysis being performed.

3.3.2 Shipping requirements and receipt

The FC will be responsible for all sample tracking and custody procedures for samples in the field. She will be responsible for final sample inventory and will maintain sample custody documentation. She will also complete COC forms prior to removing samples from the sampling area. At the end of each day, and prior to transfer, COC entries will be made for all samples. Finally, information on the labels will be checked against sample log entries, and sample tracking forms and samples will be recounted. COC forms will accompany all samples. The COC forms will be signed at each point of transfer. Copies of all COC forms will be retained and included as appendices to QA/QC reports.

Sample coolers containing samples for chemical and grain-size analyses will be hand-carried to ARI, in Tukwila, Washington. The Laboratory Project Managers will ensure that COC forms are properly signed upon receipt of the samples, and will note questions or observations concerning sample integrity on the COC records. The

Laboratory Project Manager will contact the FC immediately if discrepancies between the COC forms and the sample shipment are discovered upon receipt. The laboratory QA Officer will specifically note any coolers that are not sufficiently cold upon receipt. The laboratory will not dispose of the environmental samples or extracts associated with this project until notified in writing by the FC or the Port.

3.4 ANALYTICAL METHODS

The methods of chemical analysis are identified in Table 2-2. All methods selected represent standard methods used for the analysis of these analytes in sediments. The laboratory project manager will determine the remedy to be utilized if the project method detection limit (MDL) cannot be attained, in consultation with Windward QA officer and the EPA.

3.5 QUALITY ASSURANCE/QUALITY CONTROL

3.5.1 Field quality control criteria

Although validation guidelines have not been established for field quality control samples, their analysis is useful in identifying possible problems resulting from sample collection or sample processing in the field. All field quality control samples will be documented in the field logbook and verified by the Project QA/QC Coordinator or a designee.

Field QA/QC samples will be used to evaluate the efficiency of field decontamination procedures and variability due to sample handling. Two types of field QA/QC samples will be collected during each sampling event: a rinsate blank for the sampling equipment and a field duplicate. These two sample types are further described below. Locations for collection of field QA/QC samples will be selected in the field by the FC.

Rinsate blanks

Rinsate blanks are used to assess whether and to what degree contamination is crossing from one sample to the next during sample collection or processing. A rinsate blank is created by rinsing the decontaminated sample processing equipment with deionized water. This water is collected in a clean jar and submitted to the laboratory for analysis. A minimum of one rinsate blank for the collection and processing equipment will be submitted for chemical analysis. If a particular sample is suspected of being highly contaminated, a rinsate blank will be collected after processing that sample. The rinsate blank will be submitted to the laboratory in the same manner as the environmental samples and will be analyzed for the same analytes.

Homogenate duplicate samples

One duplicate sample will be collected from the material homogenized from one field sample and submitted for the same analyses as the field samples to evaluate heterogeneity attributable to sampling handling.

3.5.2 Chemical analyses

All sediment samples collected for chemical analysis will be analyzed for PCBs, organochlorine pesticides, SVOCs including PAHs, metals including mercury, total organic carbon, and grain size. The specific analytical methods are provided in Table 2-3.

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate MDLs for each analyte in each matrix of interest, and establish an initial calibration curve for all analytes. The laboratory must demonstrate their continued proficiency by participation in interlaboratory comparison studies and through repeated analysis of certified reference materials, calibration checks, laboratory reagent blanks, and spiked samples.

Determination of method detection limits

The MDL is defined as the lowest concentration of an analyte or compound that a method can detect in either a sample or a blank with 99% confidence. The laboratories determine MDLs using standard procedures outlined in 40CFR§136. In summary, seven replicate samples will be fortified at 1 to 5 times (but not to exceed 10 times) the expected MDL concentration. The MDL is then determined by calculating the standard deviation of the replicates and multiplying by a factor of 3.14.

Nondetected results will be reported to the sample reporting limit. For several chemicals the reporting limits may exceed the corresponding SQS/SL values. For example, this problem has occurred with chlorobenzenes and phenols. If the reporting limit exceeds the SQS/SL value then the sample extract will be submitted for SIM analysis which will result in a lower RL.

Sample delivery group

Project and/or method specific quality control measures such as matrix spikes and matrix duplicates will be analyzed per sample delivery group (SDG) or sample batch. An SDG is defined as no more than 20 samples.

Laboratory quality control criteria

The analyst will review results of QC analyses from each sample group immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits have been exceeded. If control limits are exceeded in the sample group, the Project QA/QC Coordinator will be contacted immediately, and contingency action, such as method modifications followed by reprocessing of the affected samples, will be initiated before processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented. The following sections summarize the procedures that will be used to assess data quality throughout sample analysis. Table 3-4 summarizes the QC procedures to be performed by the laboratory. The associated control limits for precision and accuracy are summarized in Table 2-2.

Table 3-4. Laboratory quality control sample analysis summary

Analysis Type	Initial Calibration	Continuing Calibration	Matrix Duplicate or Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Pesticides[a]	prior to analysis	daily	na	1 per batch or SDG	1 per batch or SDG	each batch or SDG	each sample
PCBs	prior to analysis	daily	na	1 per batch or SDG	1 per batch or SDG	each batch or SDG	each sample
Semivolatile organic compounds	prior to analysis	daily	na	1 per batch or SDG	1 per batch or SDG	each batch or SDG	each sample
Metals	daily	every 10 samples	1 per batch or SDG	1 per batch or SDG	na	each batch or SDG	na
Grain size	na	na	1 per 20 samples	na	na	na	na
Total organic carbon	daily	every 10 samples	1 per 20 samples	1 per 20 samples	na	each batch or SDG	na
Percent moisture	na	na	1 per 20 samples	na	na	na	na
Total solids	na	na	1 per 20 samples	na	na	na	na

[a] Aroclor standards will be run as interference check standards for the pesticide analysis

na – not applicable

Matrix Replicates

Analytical replicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical replicates are subsamples of the original sample that are prepared and analyzed as a separate sample, assuming sufficient sample matrix is available. A minimum of one replicate will be analyzed for each sample group or for every 20 samples, whichever is more frequent. If insufficient material is available for matrix replicates and spikes, standard reference materials will be substituted.

Matrix Spikes and Matrix Spike Duplicates

The analysis of matrix spike samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate matrix spike analyses, information on the precision of the method is also provided for organic analyses. A minimum of one matrix spike will be analyzed for each sample group or for every 20 samples, whichever is more frequent, when possible. A standard reference material will be used to assess method accuracy for those parameters that cannot be spiked.

Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample results will be corrected for recovery using these values.

Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of one method blank will be analyzed for each extraction / digestion batch or for every 20 samples, whichever is more frequent.

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

The FC will be responsible for overseeing the testing, inspection, and maintenance of all field equipment. No field equipment will require calibration. The laboratory project manager will be responsible for laboratory equipment testing, inspection, and maintenance requirements are met. The calibration methods used in calibrating the analytical instrumentation are described in the following section.

3.7 INSTRUMENT CALIBRATION AND FREQUENCY

Multipoint initial calibration will be performed on each instrument at the start of the project, after each major interruption to the analytical instrument, and when any continuing calibration does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibrations will be performed daily for organic analyses and with every sample batch for conventional parameters to ensure proper instrument performance.

In addition, if an Aroclor is detected in a sample, then the standard for that Aroclor must be analyzed in the continuing calibration within 72 hrs of the original detection of the Aroclor. Gel permeation chromatography calibration verifications will be performed at least once every 7 days and corresponding raw data will be submitted by the laboratory with the data package. In addition, florisil performance checks will be performed for every florisil lot and the resulting raw data will be submitted with the data package.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately after the continuing calibration verification at a frequency of one blank for every 10 samples analyzed for inorganic analyses and one blank for every 12 hours for organic analyses. If the continuing calibration does not meet the specified criteria, the analysis must stop. Analysis may resume after contingency actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

3.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory. For example, jars will be inspected to ensure that they are the correct size and quantity and were not damaged in shipment.

3.9 DATA MANAGEMENT

Analytical laboratories are expected to submit data in both electronic and hard copy format. The Laboratory Project Manager should contact the Project QA/QC Coordinator prior to data delivery to discuss specific format requirements.

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines ensures that all data are consistently converted into the desired data structures and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and laboratory duplicates and QA/QC samples were recorded in the data tables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project team members who use the data will have appropriate documentation.

In addition to placing all data and identifiers in an electronic database, hard copies of all original analytical data or study records will be placed in a library filing system. Each analytical data set or document will be given a unique code based on the original source of the data or information, and filed based on that code. A master list of all filed documents, sorted in order by filing code, will be maintained for easy retrieval from the library. Data management files will be stored on a secure computer or on a removable hard drive that can be secured.

4.0 Assessment/Oversight

4.1 COMPLIANCE ASSESSMENTS AND RESPONSE ACTIONS

4.1.1 Compliance assessments

Laboratory and field performance assessments consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. DMMP personnel may conduct a laboratory audit prior to sample analysis. Any pertinent laboratory audit reports will be made available to the Project QA/QC Coordinator upon request. All laboratories are required to have written procedures addressing internal QA/QC; these procedures will be submitted for review by the Project QA/QC

Coordinator to ensure compliance with the QAPP. All laboratories and QA/QC Coordinators are required to ensure that all personnel engaged in sampling and analysis tasks have appropriate training.

EPA Quality Assurance staff will receive a copy of the laboratory SOPs and MDLs prior to sample analysis.

4.1.2 Response actions for field sampling

The FC, or a designee, will be responsible for correcting equipment malfunctions throughout the field sampling effort and resolving situations in the field that may result in nonconformance or noncompliance with the QAPP. All corrective measures will be immediately documented in the field logbook, and protocol modification forms will be completed (Form 2).

4.1.3 Corrective action for laboratory analyses

All laboratories are required to comply with the standard operating procedures previously submitted to the Project QA/QC Coordinator. The laboratory project managers will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Project QA/QC Coordinator will be notified immediately if any QC sample exceeds the project-specified control limits (Table 2-3). The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Project Manager will document the corrective action taken in a memorandum submitted to the Project QA/QC Coordinator within 5 days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct it, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package using a protocol modification form (Form 2).

4.2 Reports to Management

Progress reports will be prepared by the FC following each sampling event. The Project QA/QC Coordinator will also prepare progress reports after the sampling is completed and samples have been submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event, as described in Section 2.6.4. These reports will be delivered electronically to the Windward, Port, and EPA project managers. The data report will include the data validation report and laboratory generated summaries of analytical results (Form 1s) with the associated QC results. The full analytical data package, including the raw analytical results will be available for review if requested.

5.0 Data Validation and Usability

5.1 Data Review, Validation, and Verification Requirements

Data will be used to determine contingency actions without independent validation. The data are not considered final until validated. All data, including laboratory and field QC sample results, will be summarized in a QA summary report. The QA summary report will focus on data that did not meet the data quality objectives specified in Table 2-2. The QA summary reports will be included as an appendix to the final document. The summary reports will also describe any deviations from this QAPP and actions taken to address those deviations. Data validation will be conducted following EPA (1999 and 2000b) guidance.

5.2 Validation and Verification Methods

Data verification is a process in which data are reviewed and evaluated by supervisory personnel or QA specialists within the laboratory. The laboratory analyst is responsible for ensuring that the analytical data are correct and complete, that appropriate procedures have been followed, and that QC results are within the acceptable limits. The Project QA/QC Coordinator is responsible for ensuring that all analyses performed by the laboratories are correct, properly documented, and complete, and that they satisfy the project DQOs specified in this QAPP.

Independent third-party data review and summary validation of the analytical chemistry data will be conducted by Ecochem. A minimum of 20% or a single sample delivery group will undergo full data validation. Full data validation parameters include:

- quality control analysis frequencies
- analysis holding times
- laboratory blank contamination
- instrument calibration
- surrogate recoveries
- LCS recoveries
- matrix spike recoveries
- matrix spike/matrix spike duplicate RPDs
- compound identifications
- compound quantitations
- instrument performance check (tune) ion abundances
- internal standard areas and retention time shifts

If no discrepancies are found between reported results and raw data in the set that undergoes full data validation, then validation can proceed as a summary validation on the rest of the data using all the QC forms submitted in the laboratory data package. Summary validation will include a review of calibration summary forms V, VI, VII and IX and the internal standard area and retention time summary form VIII and the GC identification summary form X. Quality assurance review of the sediment and tissue chemistry data will be performed in accordance with the QA requirements of the project, the technical specifications of the analytical methods indicated in Table 2-2 and EPA (1999; 2002b) guidance for organic and inorganic data review. The EPA PM may have EPA peer review the third-party validation or perform data assessment/validation on a percentage of the data.

5.3 Reconciliation with Data Quality Objectives

Data quality assessment will be conducted by the Project QA/QC Coordinator in consultation with DMMP guidelines. The results of the third-party independent review and validation will be reviewed and cases where the projects DQOs were not met will be identified. The usability of the data will be determined in terms of the magnitude of the DQO exceedance, as well as the importance of the data with respect to other historical data sets, and compiled and summarized in the data gaps analysis report (Windward 2001).

6.0 References

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Data Collection Forms

FORM 1: SURFACE SEDIMENT COLLECTION FORM

SURFACE SEDIMENT COLLECTION FORM

Project Name: ______________________ **Project no.:** ______________________

Date: ______________________ **Weather:** ______________________

Sampling Method: 0.1 m^2 van Veen grab **Crew:** ______________________

GRAB DATA	Location ID:			
Latitude:		Longitude:		
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Comments:**
SAMPLE DATA	**Sample ID:**			
Sediment type:	**Sediment color:**	**Sediment odor:**		**Comments:** (i.e. organic matter, wood debris, shell fragments, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand: C M F	brown	moderate	other:	
silt	gray	strong		
clay	black			

GRAB DATA	Location ID:			
Latitude:		Longitude:		
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Comments:**
SAMPLE DATA	**Sample ID:**			
Sediment type:	**Sediment color:**	**Sediment odor:**		**Comments:** (i.e. organic matter, wood debris, shell fragments, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand: C M F	brown	moderate	other:	
silt	gray	strong		
clay	black			

FORM 2: PROTOCOL MODIFICATION FORM

Project Name and Number: ____________________

Material to be Sampled: ____________________

Measurement Parameter: ____________________

Standard Procedure for Field Collection & Laboratory Analysis (cite reference):

Reason for Change in Field Procedure or Analysis Variation: ____________________

Variation from Field or Analytical Procedure: ____________________

Special Equipment, Materials or Personnel Required: ____________________

Initiator's Name: ____________________ Date: __________

Project Officer: ____________________ Date: __________

QA Officer: ____________________ Date: __________

ATTACHMENT A. HEALTH AND SAFETY PLAN

Health and Safety Plan Approval Record

By their signature, the undersigned certify that this Health and Safety Plan (HSP) is approved and that it will be used to govern health and safety aspects of fieldwork described in the attached QAPP.

Name Project Manager	Date
Name Corporate Health and Safety Manager	Date
Name Field Coordinator/Health and Safety Officer	Date

Acronyms

CPR	cardiopulmonary resuscitation
EPA	US Environmental Protection Agency
FC	field coordinator
HSM	Project Health and Safety Manager
HSO	Field Health and Safety Officer
HSP	health and safety plan
OSHA	Occupational Safety and Health Administration
PSEP	Puget Sound Estuary Program
PCBs	polychlorinated biphenyls
PFD	personal flotation device
PPE	personal protective equipment

A.1.0 Introduction

This site-specific health and safety plan (HSP) describes safe working practices for conducting field activities at potentially hazardous sites and for handling potentially hazardous materials/waste products. This HSP covers elements as specified in 29CFR1910§120.

This HSP addresses all activities associated with collection and handling of sediment samples in the East Waterway of the Duwamish River adjacent to Harbor Island, Seattle, WA. During site work, this HSP will be implemented by the Field Coordinator (FC), who is also the designated site Health and Safety Officer (HSO), in cooperation with the Corporate Health and Safety Manager (HSM) and the Project Manager.

All personnel involved in fieldwork on this project are required to comply with this HSP. The contents of this HSP reflect the types of activities to be performed, knowledge of the physical characteristics of the site, and consideration of preliminary chemical data from previous investigations at the site. The HSP may be revised based on new information and/or changed conditions during site activities. Revisions will be documented in the project records.

A.2.0 Site Description and Project Scope

A.2.1 Site Description

The sampling area is in the East Waterway of the Duwamish River. The area is affected by tidal fluctuations. The QAPP to which this HSP is attached provides complete details of the sampling program. The following section summarizes the types of work that will be performed during field activities.

A.2.2 Scope and Duration of Work

Specific tasks that will be performed are as follows:

- Collection of sediment samples from the East Waterway using a hydraulic power-grab sampler deployed from a boat
- Sample handling, processing, and shipping

A.3.0 Health and Safety Personnel

Key health and safety personnel and their responsibilities are described below. These individuals are responsible for the implementation of this HSP.

Project Manager: The Project Manager has overall responsibility for the successful outcome of the project. The Project Manager will ensure that adequate resources and budget are provided for the health and safety staff to carry out their responsibilities during fieldwork. The Project Manager, in consultation with the HSM, makes final decisions concerning implementation of the HSP.

Field Coordinator/Health and Safety Officer: Because of the limited scope of fieldwork, the Field Coordinator (FC) and Health and Safety Officer (HSO) will be the same person. The FC / HSO will direct field sampling activities, coordinate the technical components of the field program with health and safety components, and ensure that work is performed according to the sampling and analysis plan.

The FC / HSO will implement this HSP at the work location and will be responsible for all health and safety activities and the delegation of duties to a health and safety technician in the field, if appropriate. The FC / HSO also has stop-work authority, to be used if there is an imminent safety hazard or potentially dangerous situation. The FC / HSO or his designee will be present during sampling and operations.

Corporate Health and Safety Manager: The HSM has overall responsibility for preparation, approval, and revisions of this HSP. The HSM will not necessarily be present during fieldwork, but will be readily available, if required, for consultation regarding health and safety issues during fieldwork.

Field Crew: All field crew members must be familiar with and comply with the information in this HSP. They also have the responsibility to report any potentially unsafe or hazardous conditions to the FC / HSO immediately.

A.4.0 Hazard Evaluation and Control Measures

This section covers potential physical and chemical hazards that may be associated with the proposed project activities, and presents control measures for addressing these hazards. The activity hazard analysis, Section A.4.3, lists the potential hazards associated with each site activity and the recommended site control to be used to minimize each potential hazard.

Confined space entry will not be necessary for this project. Therefore, hazards associated with this activity are not discussed in this HSP.

A.4.1 Physical Hazards

For this project, it is anticipated that physical hazards will present a greater risk of injury than chemical hazards. Physical hazards are identified and discussed below.

A.4.1.1 Slips, trips, and falls

As with all fieldwork sites, caution should be exercised to prevent slipping on slick surfaces. In particular, sampling from a boat or other floating platform requires careful attention to minimize the risk of falling down or of falling overboard. The same care should be used in rainy conditions or on the shoreline where slick rocks are found. Slipping can be minimized by wearing boots with good tread and made of material that does not become overly slippery when wet.

Tripping is always a hazard on the uneven deck of a boat, in a cluttered work area, or in the intertidal zone where uneven substrate is common. Personnel will keep work areas as free as possible from items that interfere with walking.

Falls may be avoided by working as far from exposed edges as possible, by erecting railings, and by using fall protection when working on elevated platforms. For this project, no work is anticipated that would present a fall hazard on land. However, some of the sampling will be done from a boat. As with any work from a floating platform, there is a chance of falling overboard. Personal flotation devices (PFDs) will be worn while working from the boat.

A.4.1.2 Sampling equipment deployment

A hydraulic power-grab sampler will be used to collect sediment samples. This device uses fluid actuation to close the sampler jaws after the sample has been lowered to the bottom. Before sampling activities begin, there will be a training session for all field personnel pertaining to the equipment that will be onboard the sampling vessel and used onshore. The sampling vessel is equipped with hydraulic winches that lower and raise the sampling equipment.

A.4.1.3 Manual lifting

Equipment and samples must be lifted and carried. Back strain can result if lifting is done improperly. During any manual handling tasks, personnel should lift with the load supported by their legs and not their backs. For heavy loads, an adequate number of people will be used or, if possible, a mechanical lifting/handling device will be employed.

A.4.1.4 Heat stress, hypothermia, frostbite

The sampling operations are not anticipated to result in conditions that might result in heat stress, hypothermia, or frostbite.

A.4.1.5 Weather

In general, field team members will be equipped for the normal range of weather conditions. The FC/HSO will be aware of current weather conditions and of the potential for those conditions to pose a hazard to the field crew. Some conditions that might force work stoppage are electrical storms, high winds, or high waves resulting from winds.

A.4.2 Chemical Hazards

Previous investigations have shown that some chemical substances are present in the sampling area at higher-than-background concentrations. For the purposes of discussing potential exposure to substances in sediments, the chemicals of concern are metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). In addition, there is potential for exposure to hydrogen sulfide gas from sediments.

A.4.2.1 Exposure routes

Potential routes of chemical exposure include inhalation, dermal contact, and ingestion. Exposure will be minimized by using safe work practices and by wearing the appropriate personal protective equipment (PPE). Further discussion of PPE requirements is presented in Section A.6.

Inhalation — Because wet sediment does not generate dust particles, and because surface water spray is expected to be minimal, inhalation of particulates is not expected to be an important route of exposure. Potential exposure is possible via inhalation of hydrogen sulfide gas emitted from sediments. During sediment handling activities, the risk of inhalation exposure is reduced because work is performed in open-air conditions.

Dermal exposure — Dermal exposure to hazardous substances associated with sediments, surface water, or equipment decontamination will be controlled by the use of PPE and by adherence to detailed sampling and decontamination procedures.

Ingestion — Ingestion is not considered a major route of exposure for this project. Accidental ingestion of sediment is possible, but proper sediment handling should prevent sediment splattering, which will ensure that sediment droplets do not become airborne. Accidental ingestion of surface water is possible. However, careful handling of equipment and containers aboard the boat should prevent the occurrence of water splashing or spilling during sample collection and handling activities.

A.4.2.2 Description of chemical hazards

Metals and tributyltin — Exposure to metals may occur via ingestion or skin contact. As mentioned above, neither is likely as an exposure route. Metal fumes or metal-contaminated dust will not be encountered during field and sample handling activities. Large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the metals into the body. Field procedures require immediate washing of sediments from exposed skin.

Petroleum hydrocarbons and PAHs — Exposure to petroleum hydrocarbons and PAHs may occur via ingestion or skin contact. Inhalation, the most important human health exposure pathway for this group of chemicals, is not expected to occur at this site. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people. Some PAHs are suspected human carcinogens. However, large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the compounds into the body. Field procedures require immediate washing of sediments from exposed skin.

Polychlorinated biphenyls — Prolonged skin contact with PCBs may cause acne-like symptoms known as chloracne. Irritation to eyes, nose, and throat may also occur. Acute and chronic exposure can damage the liver and cause symptoms of edema, jaundice, anorexia, nausea, abdominal pains, and fatigue. PCBs are suspected human carcinogens. Skin absorption may substantially contribute to the uptake of PCBs. However, large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the compounds into the body. Field procedures require immediate washing of sediments from exposed skin.

Hydrogen sulfide — Hydrogen sulfide is a chemical that is naturally produced as a gas from the sediments that is potentially toxic via inhalation, ingestion, and skin and eye contact. Inhalation can result in respiratory irritation, rhinitis, and edema of the lungs. Subacute exposures to hydrogen sulfide may result in headache, dizziness, staggering gait, and agitation. Acute exposure at higher concentrations may result in immediate coma and possibly death as a consequence of respiratory failure. Based on previous sampling results, inhalation and eye contact are not expected to occur to a significant degree at this site. Large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the compounds into the body. Field procedures require immediate washing of sediments from exposed skin.

A.4.3 Activity Hazard Analysis

The activity hazard analysis summarizes the field activities to be performed during the project, outlines the hazards associated with each activity, and presents controls that can reduce or eliminate the risk of the hazard occurring.

Table A-1 presents the activity hazard analysis for the following activities:

- Sediment sampling from boat
- Sample handling, processing, and shipping
- Equipment decontamination

Table A-1. Activity hazard analysis

ACTIVITY	HAZARD	CONTROL
Sediment sampling from a boat	Falling overboard	Use care in boarding/departing from vessel. Deploy and recover the sampler over the stern. Wear PFD.
	Skin contact with contaminated sediments or liquids	Wear modified Level D PPE.
	Injury from equipment falling or swinging	Wear a hard hat at all times and make sure you are in the appropriate position on deck when equipment is in operation
	Fire	Mop up any flammable materials and dispose of absorbent. No smoking or flame sources in the boat. Evacuate the boat according to procedures outlined in the training session given by the vessel captain.
Sample handling, packaging, and shipping	Skin contact with contaminated sediments or liquids	Wear modified Level D PPE.
	Back strain	Use appropriate lifting technique when handling filled sample coolers, or seek help.
Equipment decontamination	Inhalation of or eye contact with airborne mists or vapors	Wear safety glasses. Perform decontamination activities outdoors or in a well-ventilated area. Stay upwind when spray-rinsing equipment.
	Skin contact with contaminated materials	Wear modified Level D PPE.
	Ingestion of contaminated materials	Decontaminate clothing and skin prior to eating, drinking, smoking, or other hand-to-mouth activities. Follow the decontamination procedure for personal decontamination.

A.5.0 Work Zones and Shipboard Access Control

During sampling and sample handling activities, work zones will be established to identify where sample collection and processing are actively occurring. The intent of the zone is to limit the migration of sample material out of the zone and to restrict access to active work areas by defining work zone boundaries.

A.5.1 WORK ZONE

The work zone aboard the boat will encompass the area where sample collection and handling activities are performed. On the boat, the FC / HSO will delineate the work zone as a particular area of the vessel if actual physical barriers are not practical. Only persons with appropriate training, PPE, and authorization from the FC / HSO will be allowed to enter the work zone while work is in progress.

A.5.2 DECONTAMINATION STATION

A decontamination station will be set up, and personnel will clean soiled boots or PPE prior to leaving the work zone. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to clean boots, PPE, or other equipment leaving the work zones. Plastic bags will be provided for expendable and disposable materials. If the location does not allow the establishment of a decontamination station, the FC / HSO will provide alternatives to prevent the spread of contamination.

A.5.3 ACCESS CONTROL

Security and control of access to the boat will be the responsibility of the FC / HSO and boat captain. Boat access will be granted only to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

A.6.0 Safe Work Practices

Following common sense rules will minimize the risk of exposure or accidents at a work site. These general safety rules will be followed on site:

- Do not climb over or under obstacles of questionable stability
- Do not eat, drink, smoke, or perform other hand-to-mouth transfers in the work zone
- Work only in well-lighted spaces
- Make eye contact with equipment operators when moving within the range of their equipment
- Be aware of the movements of shipboard equipment when not in the operator's range of vision
- Get immediate first aid for all cuts, scratches, abrasions, or other minor injuries
- Use the established sampling and decontamination procedures
- Always use the buddy system
- Be alert to your own and other workers' physical condition
- Report all accidents, no matter how minor, to the FC / HSO
- Do not do anything dangerous or unwise even if ordered by a supervisor

A.7.0 Personal Protective Equipment and Safety Equipment

Appropriate PPE will be worn as protection against potential hazards. In addition, a PFD will be required when working aboard the boat. Prior to donning PPE, the field crew will inspect their PPE for any defects that might render the equipment ineffective.

Fieldwork will be conducted in Level D or modified Level D PPE, as discussed below in Sections A.7.1 and A.7.2. Situations requiring PPE beyond modified Level D are not anticipated. Should the FC / HSO determine that PPE beyond modified Level D is necessary, the HSM will be notified and an alternative selected.

A.7.1 Level D Personal Protective Equipment

Workers performing general activities in which skin contact with contaminated materials is unlikely will wear Level D PPE. Level D PPE includes the following:

- Cotton overalls or lab coats
- Chemical-resistant steel-toed boots
- Chemical-resistant gloves
- Safety glasses
- Hard hat (if overhead hazard exists)

A.7.2 Modified Level D Personal Protective Equipment

Workers performing activities where skin contact with contaminated materials is possible and in which inhalation risks are not expected will be required to wear an impermeable outer suit. The type of outerwear will be chosen according to the types of chemical contaminants that might be encountered. Modified Level D PPE includes the following:

- Impermeable outer garb such as rain gear
- Chemical-resistant steel-toed boots
- Chemical-resistant outer gloves
- Safety glasses (or face shield, if significant splash hazard exists)
- Hard hat (if overhead hazard exists)

A.7.3 Safety Equipment

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment for the field team will include:

- A copy of this HSP
- First aid kit adequate for the number of personnel
- Emergency eyewash

The FC / HSO will ensure that the safety equipment is aboard. Equipment will be checked daily to ensure its readiness for use.

A.8.0 Monitoring Procedures for Site Activities

A monitoring program that addresses the potential site hazards will be maintained. For this project, air, dust, and noise monitoring will not be necessary. No volatile organic compounds have been identified among the expected contaminants, the sampled media will be wet and will not pose a dust hazard, and none of the equipment emits high-amplitude (>85 dBA) sound. For this project, the monitoring program will consist of all workers monitoring themselves and their co-workers for signs that might indicate physical stress or illness.

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Symptoms of heat stress
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Shivering
- Blue lips or fingernails

If any of these conditions develop, work shall be halted immediately and the affected person(s) evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the direct result of sample collection or handling activities, procedures will be modified to address the problem.

A.9.0 Decontamination

Decontamination is necessary to prevent the migration of contaminants from the work zone(s) into the surrounding environment and to minimize the risk of exposure of personnel to contaminated materials that might adhere to PPE. The following sections discuss personnel and equipment decontamination. The following supplies will be available to perform decontamination activities:

- Wash buckets
- Rinse buckets
- Long-handled scrub brushes
- Clean water sprayers
- Paper towels
- Plastic garbage bags
- Alconox® or similar decontamination solution
- Seawater hose

A.9.1 MINIMIZATION OF CONTAMINATION

The first step in addressing contamination is to prevent or minimize exposure to existing contaminated materials and the spread of those materials. During field activities, the FC / HSO will enforce the following measures:

Personnel:

- Do not walk through areas of obvious or known contamination
- Do not handle, touch, or smell contaminated materials directly
- Make sure PPE has no cuts or tears prior to use
- Fasten all closures on outer clothing, covering with tape if necessary
- Protect and cover any skin injuries
- Stay upwind of airborne dusts and vapors
- Do not eat, drink, chew tobacco, or smoke in the work zones

Sampling equipment and boat:

- Use care to avoid getting sampled media on the outside of sample containers
- If necessary, bag sample containers before filling with sampled media
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media
- Keep contaminated equipment and tools separate from clean equipment and tools
- On the boat, fill sample containers over a plastic tub to contain spillage
- Clean up spilled material immediately to avoid tracking around the boat
- Clean boots before entering the boat cabin

A.9.2 PERSONNEL DECONTAMINATION

The FC / HSO will ensure that all site personnel are familiar with personnel decontamination procedures. Personnel will perform decontamination procedures, as appropriate, before eating lunch, taking a break, or before leaving the work location. Following is a description of these procedures.

Decontamination procedure:

1. If outer suit is heavily soiled, rinse it off
2. Wash and rinse outer gloves and boots in portable buckets or with sea hose
3. Remove outer gloves; inspect and discard if damaged
4. Wash hands if taking a break
5. Don necessary PPE before returning to work

Dispose of soiled, expendable PPE before leaving for the day

A.9.3 SAMPLING AND HOMOGENIZING EQUIPMENT DECONTAMINATION

Sediment sampling equipment and homogenization implements and mixing containers will be decontaminated before use at each sampling station using a field decontamination protocol based on PSEP (1997) guidelines. Before use at each sampling location, the grab sampler will be rinsed thoroughly with seawater to dislodge and remove any remaining sediments.

The homogenization equipment decontamination procedure is as follows:

- Rinse with site water and wash with scrub brush to remove sediment
- Wash with tap water and Alconox® solution
- Rinse with tap water
- Rinse with deionized water

The sampling gear decontamination procedure aboard the boat is as follows:

- Rinse with site water and wash with scrub brush until free of sediment
- Final rinse with site water before deploying overboard

A.10.0 Disposal of Contaminated Materials

Contaminated materials that may be generated during field activities include PPE, decontamination fluids, and excess sample material. These contaminated materials will be disposed of as an integral part of the project.

A.10.1 PERSONAL PROTECTIVE EQUIPMENT

Gross surface contamination will be removed from PPE. All disposable sampling materials and PPE, such as disposable coveralls, gloves, and paper towels used in sample processing, will be placed in heavyweight garbage bags. Filled garbage bags will be placed in a normal refuse container for disposal as solid waste.

A.10.2 DECONTAMINATION RINSATES

Detergent-bearing liquid wastes from decontamination of the equipment will be stored in 5-gallon carboys. Carboys will be disposed to a sanitary sewer drain.

A.10.3 EXCESS SAMPLE MATERIALS

At each sampling location, all excess sample volume of each sampled medium will be returned overboard. Rejected samples, if any, will also be returned overboard.

A.11.0 Training Requirements

Individuals performing work at locations where potentially hazardous materials and conditions may be encountered must meet specific training requirements. Because hazardous contaminant concentrations are not expected, training will be site-specific and an experienced person will oversee all inexperienced personnel for one working day. The following sections describe the training requirements for this fieldwork.

A.11.1 PROJECT-SPECIFIC TRAINING

All personnel must read this HSP and be familiar with its contents before beginning work. They will acknowledge reading the HSP by signing the attached field team HSP review form. The form will be kept in the project files.

The boat captain and FC/HSO or a designee will provide project-specific training prior to the first day of fieldwork and whenever new workers arrive onboard. Field personnel will not be allowed to begin work until project-specific training is completed and documented by the FC/HSO. Training will address the HSP and all health and safety issues and procedures pertinent to field operations. Training will include, but not be limited to, the following topics:

- Activities with the potential for chemical exposure
- Activities that pose physical hazards and actions to control the hazard
- Ship access control and procedure
- Hazard communications for materials brought onto site
- Use and limitations of PPE
- Decontamination procedures
- Emergency procedures

- Use and hazards of sampling equipment
- Location of emergency equipment on the vessel
- Vessel safety practices
- Vessel evacuation and emergency procedures

A.11.2 DAILY SAFETY BRIEFINGS

The FC / HSO or a designee and the boat captain will present safety briefings before the start of each day's activities. These safety briefings will outline the activities expected for the day, update work practices and hazards, address any specific concerns associated with the work location, and review emergency procedures and routes. The FC / HSO or designee will document safety briefings in the logbook.

A.11.3 FIRST AID AND CPR

At least one member of the field team must have first-aid and cardiopulmonary resuscitation (CPR) training. Documentation of which individuals possess first-aid and CPR training will be kept in the project health and safety files.

A.12.0 Medical Surveillance

A medical surveillance program conforming to the provisions of 29 CFR 1910§120(f) is not necessary for field team members because they do not meet any of the four criteria outlined in the regulations for implementation of a medical surveillance program:

- Employees who are or may be exposed to hazardous substances or health hazards at or above permissible exposure levels for 30 days or more per year (1910.120[f][2][I])
- Employees who must wear a respirator for 30 days or more per year (1910.120[f][2][ii])
- Employees who are injured or become ill due to possible overexposures involving hazardous substances or health hazards from an emergency response or hazardous waste operation (1910.120[f][2][iii])
- Employees who are members of HAZMAT teams (1910.120[f][2][iv])

As described in Section A.8, employees will monitor themselves and each other of any deleterious changes in their physical or mental condition during the performance of all field activities.

A.13.0 Reporting and Record Keeping

Each member of the field crew will sign the HSP review form (attached). If necessary, accident/incident report forms and OSHA Form 200s will be completed by the FC/HSO.

The FC/HSO or a designee will maintain a health and safety field logbook that records health- and safety-related details of the project. Alternatively, entries may be made in the field logbook, in which case a separate health and safety logbook will not be required. The logbook must be bound and the pages numbered consecutively. Entries will be made with indelible blue ink. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all personnel onboard
- Weather conditions
- Type of fieldwork being performed

The person maintaining the entries will initial and date the bottom of each completed page. Blank space at the bottom of an incompletely filled page will be lined out. Each day's entries will begin on the first blank page after the previous workday's entries.

A.14.0 Emergency Response Plan

As a result of the hazards onboard and the conditions under which operations will be conducted, the potential exists for an emergency situation to occur. Emergencies may include personal injury, exposure to hazardous substances, fire, explosion, or release of toxic or non-toxic substances (spills). OSHA regulations require that an emergency response plan be available for use onboard to guide actions in emergency situations.

Onshore organizations will be relied upon to provide response in emergency situations. The local fire department and ambulance service can provide timely response. Field personnel will be responsible for identifying an emergency situation; providing first aid, if applicable; notifying the appropriate personnel or agency; and evacuating any hazardous area. Shipboard personnel will attempt to control only very minor hazards that could present an emergency situation, such as a small fire, and will otherwise rely on outside emergency response resources.

The following sections identify the onboard individual(s) who should be notified in case of emergency, provide a list of emergency telephone numbers, offer guidance for particular types of emergencies, and provide directions and a map for getting from any sampling location to a hospital.

A.14.1 PRE-EMERGENCY PREPARATION

Before the start of field activities, the FC / HSO will ensure that preparation has been made in anticipation of emergencies. Preparatory actions include the following:

- Meeting with the FC / HSO and equipment handlers concerning the emergency procedures in the event that a person is injured.
- A training session given by the FC / HSO informing all field personnel of emergency procedures, locations of emergency equipment and their use, and proper evacuation procedures.
- A training session given by senior staff operating field equipment to apprise field personnel of operating procedures and specific risks associated with that equipment.
- Ensuring that field personnel are aware of the existence of the emergency response plan in the HSP and ensuring that a copy of the HSP accompanies the field team.

A.14.2 PROJECT EMERGENCY COORDINATOR

The FC / HSO will serve as the Project Emergency Coordinator in the event of an emergency. She will designate his replacement for times when he is not onboard or is not serving as the Project Emergency Coordinator. The designation will be noted in the logbook. The Project Emergency Coordinator will be notified immediately when an emergency is recognized. The Project Emergency Coordinator will be responsible for evaluating the emergency situation, notifying the appropriate emergency response units, coordinating access with those units, and directing interim actions onboard before the arrival of emergency response units. The Project Emergency Coordinator will notify the HSM and the Project Manager as soon as possible after initiating an emergency response action. The Project Manager will have responsibility for notifying the client.

A.14.3 EMERGENCY RESPONSE CONTACTS

All onboard personnel must know whom to notify in the event of an emergency situation, even though the FC / HSO has primary responsibility for notification. Table A-2 lists the names and phone numbers for emergency response services and individuals.

Table A-2. Emergency response contacts

CONTACT	TELEPHONE NUMBER
Emergency Numbers	
Ambulance	911
Police	911
Fire	911
Harborview Medical Center	(206) 323-3074
Emergency Responders	
US Coast Guard	
Emergency General information	(206) 286-5400 (206) 442-5295 UHF Channel 16
National Response Center	(800) 424-8802
EPA	(908) 321-6660
Washington State Department of Ecology – Northwest Region Spill Response (24-hour emergency line)	(206) 649-7000
Emergency Contacts	
Project Manager	
Susan McGroddy	(206) 577-1292
Corporate Health and Safety Manager	
Tad Deshler	(206) 577-1285
Field Coordinator/ Field Health and Safety Officer	Site cellular telephone:
Thai Do	(206) 295-8956

A.14.4 RECOGNITION OF EMERGENCY SITUATIONS

Emergency situations will generally be recognizable by observation. An injury or illness will be considered an emergency if it requires treatment by a medical professional and cannot be treated with simple first-aid techniques.

A.14.5 DECONTAMINATION

In the case of evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. If an injured individual is also heavily contaminated and must be transported by emergency vehicle, the emergency response team will be told of the type of contamination. To the extent possible, contaminated PPE will be removed, but only if doing so does not exacerbate the injury. Plastic sheeting will be used to reduce the potential for spreading contamination to the inside of the emergency vehicle.

A.14.6 FIRE

Field personnel will attempt to control only small fires, should they occur. If an explosion appears likely, personnel will follow evacuation procedures specified during the training session. If a fire cannot be controlled with a fire extinguisher on board that is part of the required safety equipment, personnel will either withdraw from the vicinity of the fire or evacuate the boat as specified in the training session.

A.14.7 PERSONAL INJURY

In the event of serious personal injury, including unconsciousness, possibility of broken bones, severe bleeding or blood loss, burns, shock, or trauma, the first responder will immediately do the following:

- Administer first aid, if qualified
- If not qualified, seek out an individual who is qualified to administer first aid, if time and conditions permit
- Notify the Project Emergency Coordinator of the incident, the name of the individual, the location, and the nature of the injury

The Project Emergency Coordinator will immediately do the following:

- Notify the boat captain and the appropriate emergency response organization.
- Assist the injured individual.
- Follow the emergency procedures for retrieving or disposing equipment reviewed in the training session and travel to the predetermined, land-based, emergency pick-up site.
- Designate someone to accompany the injured individual to the hospital.
- If a life-threatening emergency occurs (i.e., injury where death is imminent without immediate treatment), the FC/HSO or boat captain will call 911 and arrange to meet the Medic One unit at the nearest accessible dock. Otherwise, for emergency injuries that are not life threatening (i.e., broken bones, minor lacerations, etc.) the Project Emergency Coordinator will follow the procedures outlined above and proceed to the Harbor Island Marina or to an alternative location of his choice if that would be more expedient.
- Notify the HSM and the Project Manager.

If the Project Emergency Coordinator determines that emergency response is not necessary, he or she may direct someone to decontaminate and transport the individual by vehicle to the nearest hospital. Directions and a map showing the route to the hospital are in Section A.14.10.

If a worker leaves the ship to seek medical attention, another worker should accompany him/her to the hospital. When in doubt about the severity of an injury or exposure, always seek medical attention as a conservative approach, and notify the Project Emergency Coordinator.

The Project Emergency Coordinator will have responsibility for completing all accident/incident field reports, OSHA Form 200s, and other required follow-up forms.

A.14.8 Overt Personal Exposure or Injury

If an overt exposure to toxic materials occurs, the first responder to the victim will initiate actions to address the situation. The following actions should be taken, depending on the type of exposure.

A.14.8.1 Skin contact

- Wash / rinse the affected area thoroughly with copious amounts of soap and water
- If eye contact has occurred, eyes should be rinsed for at least 15 minutes using the eyewash that is part of the emergency equipment onboard
- After initial response actions have been taken, seek appropriate medical attention

A.14.8.2 Inhalation

- Move victim to fresh air
- Seek appropriate medical attention

A.14.8.3 Ingestion

- Seek appropriate medical attention

A.14.8.4 Puncture wound or laceration

- Seek appropriate medical attention

A.14.9 Spills and Spill Containment

No bulk chemicals or other materials subject to spillage are expected to be used during this project. Accordingly, no spill containment procedure is required for this project.

A.14.10 EMERGENCY ROUTE TO THE HOSPITAL

The name, address, and telephone number of the hospital that will be used to provide medical care is as follows:

Harborview Medical Center
325 - 9th Ave
Seattle, WA
(206) 323-3074

Figure A-1 is a map of the route from the site to Harborview Medical Center. Directions from the vicinity of Harbor Island to Harborview Medical Center are as follows:

- Dock the vessel at the Harbor Island Marina
- Drive east on Spokane Street
- Look for entrance ramps to I-5 northbound and I-90 eastbound
- Head north on I-5
- Take the James Street exit
- Head east on James Street to 9th Avenue
- Turn right on 9th Avenue
- Emergency entrance will be two blocks south on the right

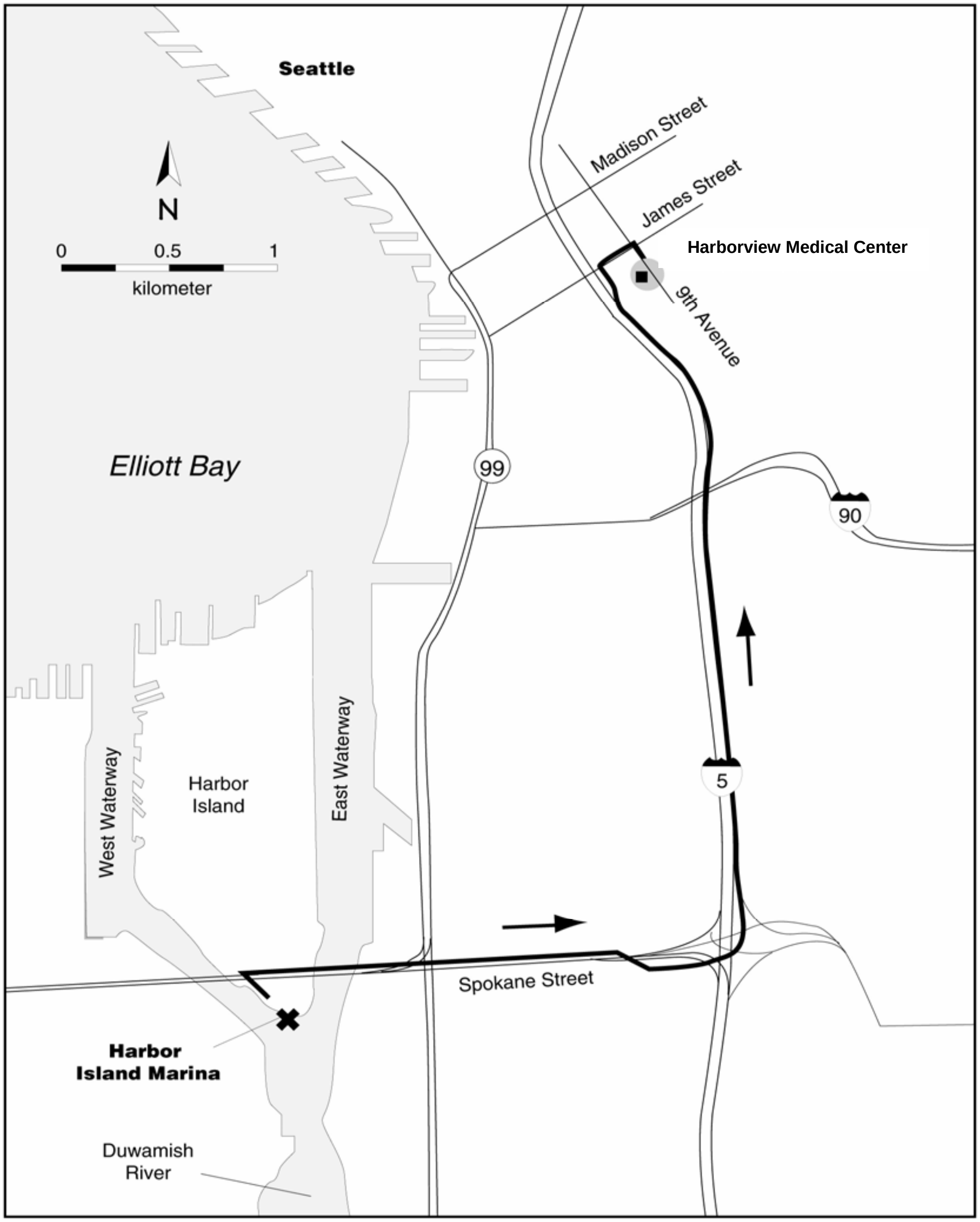

Figure A-1. Route from Harbor Island Marina to Harborview Medical Center

A.15.0 References

PSEP. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. Final Report. Prepared for the US Environmental Protection Agency, Seattle, Washington, and the Puget Sound Water Quality Action Team, Olympia, WA.

Field Team Health and Safety Plan Review

I have read a copy of the Health and Safety Plan, which covers field activities that will be conducted to investigate potentially contaminated areas in the East Waterway. I understand the health and safety requirements of the project, which are detailed in this Health and Safety Plan.

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Table B-1. Comparison of sediment RLs and MDLs to sediment ACGs

METHOD AND ANALYTE	RL[a] (mg/kg dw)	MDL[a] (mg/kg dw)	SEDIMENT ACG[b] (mg/kg dw)
EPA Method 8270C			
PAHs			
Acenaphthylene	0.02	0.00909	0.33
Benzo(a)anthracene	**0.02**	**0.00834**	0.0052
Benzo(a)pyrene	**0.02**	**0.00731**	0.00076
Benzo(b)fluoranthene	**0.02**	**0.00734**	0.0047
Benzo(k)fluoranthene	0.02	0.0104	0.047
Total benzofluoranthenes [c]	0.02	0.0104	1.2
Benzo(g,h,i)perylene	0.02	0.00804	0.16
Chrysene	0.02	0.00809	0.48
Dibenzo(a,h)anthracene	0.02	0.00835	0.06
Fluoranthene	0.02	0.00849	0.80
Indeno(1,2,3-cd)pyrene	**0.02**	**0.00854**	0.0029
Phenanthrene	0.02	0.00863	0.50
Pyrene	0.02	0.00872	5.0
Acenaphthene	0.02	0.00936	0.08
Anthracene	0.02	0.00869	1.1
Fluorene	0.02	0.00917	0.12
Naphthalene	0.02	0.00753	0.50
2-Methylnaphthalene	0.02	0.00721	0.19
Dibenzofuran	0.02	0.00795	0.075
Total LPAHs [d]	0.02	0.00936	1.9
Total HPAHs [e]	0.02	0.0104	4.8
Total PAHs [f]	0.02	0.0104	1,410
Other SVOCs			
1,2,4-Trichlorobenzene	**0.02**	**0.00588**	0.0041
1,2-Dichlorobenzene	**0.02**	0.00876	0.012
1,3-Dichlorobenzene	0.02	0.00755	0.17
1,4-Dichlorobenzene	**0.02**	0.00816	0.016
2,4,5-Trichlorophenol	0.10	0.00834	610
2,4,6-Trichlorophenol	0.10	0.010	0.61
2,4-Dichlorophenol	0.10	0.00773	18
2,4-Dimethylphenol	0.02	0.01052	0.029

Method and Analyte	RL[a] (mg/kg dw)	MDL[a] (mg/kg dw)	Sediment ACG[b] (mg/kg dw)
2,4-Dinitrophenol	0.20	0.1042	12
2,4-Dinitrotoluene	0.10	0.00897	12
2,6-Dinitrotoluene	0.10	0.01073	6.1
2-Chloronaphthalene	0.02	0.00832	490
2-Chlorophenol	0.20	0.00948	6.3
2-Methylphenol	0.02	0.0138	0.063
3,3'-Dichlorobenzidine	0.10	0.0617	1.1
4-Chloroaniline	0.10	0.0257	24
4-Methylphenol	0.10	0.0135	0.67
Aniline	0.02	0.00912	85
Benzoic acid	0.20	0.105	0.65
Benzyl alcohol	0.40	0.041	0.057
Bis(2-chloroethyl)ether	0.02	0.00993	0.21
Bis(2-ethylhexyl)phthalate	0.02	0.0108	0.24
Bis-chloroisopropyl ether	0.02	0.00996	2.9
Butyl benzyl phthalate	0.02	0.0103	0.025
Di-ethyl phthalate	0.02	0.135	0.31
Dimethyl phthalate	0.02	0.0120	0.27
Di-n-butyl phthalate	0.02	0.0135	1.1
Di-n-octyl phthalate	0.02	0.0113	0.29
Hexachlorobenzene	**0.02**	**0.00928**	0.0019
Hexachlorobutadiene	0.02	0.00828	0.02
Hexachloroethane	0.02	0.00798	0.12
Isophorone	0.02	0.00738	510
Nitrobenzene	0.02	0.0159	2.0
N-Nitrosodimethylamine	**0.10**	**0.00912**	0.0095
N-Nitrosodi-n-propylamine	**0.10**	0.0102	0.069
N-Nitrosodiphenylamine	0.02	0.0107	0.055
Pentachlorophenol	0.10	0.0371	0.36
Phenol	0.02	0.00947	0.42
EPA Method 8270C-SIM			
1,2,4-Trichlorobenzene	**0.0067**	tbd	0.0041
1,2-Dichlorobenzene	0.0067	tbd	0.012
1,4-Dichlorobenzene	0.0067	tbd	0.016
2,4-Dimethylphenol	0.0067	tbd	0.029
2-Methylphenol	0.0067	tbd	0.063
Benzoic acid	0.067	tbd	0.65
Benzyl alcohol	0.017	tbd	0.057

Method and Analyte	RL[a] (mg/kg dw)	MDL[a] (mg/kg dw)	Sediment ACG[b] (mg/kg dw)
Butyl benzyl phthalate	0.0067	tbd	0.025
Di-ethyl phthalate	0.0067	tbd	0.31
Dimethyl phthalate	0.0067	tbd	0.27
Hexachlorobenzene	**0.0067**	tbd	0.0019
Hexachlorobutadiene	0.0067	tbd	0.12
N-Nitrosodimethylamine	**0.033**	tbd	0.0095
N-Nitrosodiphenylamine	0.0067	tbd	0.055
N-Nitrosodi-n-propylamine	0.033	tbd	0.069
Pentachlorophenol	0.033	tbd	0.36
EPA Method 8082			
Total PCBs [g]	0.02	0.00098	0.24
EPA Method 6010 (except as noted)			
Antimony (EPA 6020)	0.20	0.005	150
Arsenic (EPA 6020)	0.20	0.02	57
Cadmium	0.20	0.02	5.1
Chromium	0.50	0.09	260
Copper	0.20	0.04	390
Lead	2.00	0.12	450
Nickel	1.00	0.38	140
Selenium	5.00	0.3	14.9
Silver	0.30	0.03	6.1
Thallium (EPA 6020)	0.20	0.003	na
Vanadium	0.30	0.03	na
Zinc	0.60	0.29	410
EPA Method 7471			
Mercury	0.05	0.003	0.41
EPA Method 8081			
Total DDT [j]	**0.002**	**0.0011**	0.0069
Aldrin	**0.001**	0.000054	0.010
alpha-BHC	**0.001**	0.000214	0.09
beta-BHC	0.001	0.000045	0.00063
alpha-Chlordane	0.001	0.000144	0.010
Dieldrin	0.001	0.000049	0.010
gamma-BHC (Lindane)	0.001	0.000141	0.010
Heptachlor	0.001	0.000027	0.010

na – not available; the method detection limit for PCB and dioxin congeners is a sample-specific detection limit, which is calculated from specific sample analyses

tbd – to be determined; ARI is currently conducting an MDL study for these analytes for this method

RLs or MDLs in BOLD are greater than at least one of their respective ACGs. All of the ACGs that are lower than RLs or MDLs are based on human health RBCs, with the exception of the following four chemicals, which are based on benthic invertebrate RBCs: 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and hexachlorobenzene.

[a] RLs and MDLs from ARI

[b] ACG for sediment is the lowest of the RBCs for benthic invertebrates, spotted sandpipers, and humans.

[c] Total benzofluoranthenes is the sum of benzo(b)fluoranthene and benzo(k)fluoranthene. RL and MDL are the highest of the RLs and MDLs for benzo(b)fluoranthene or benzo(k)fluoranthene.

[d] Total LPAHs is the sum of naphthalene, 2-methyl naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. RL and MDL are the highest RL and MDL for the LPAHs.

[e] Total HPAHs is the sum of fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. RL and MDL are the highest RL and MDL for the HPAHs.

[f] Total PAHs is the sum of the LPAHs and the HPAHs. RL and MDL are the highest RL and MDL for either the LPAHs or HPAHs.

[g] Total PCBs is the sum of the Aroclors. RL and MDL are the highest RL and MDL for the individual Aroclors.

[i] Chromium cannot be analyzed by Method 6020 (ICP-MS) because of interferences.

[j] Total DDT is the sum of 4,4'-DDD, 4,4-DDE, 4,4'-DDT, 2,4'-DDD, 2,4-DDE, and 2,4'-DDT. RL and MDL are the highest RL and MDL for the DDT isomers.

[k] Total chlordane is the sum of oxychlordane, alpha- and gamma-chlordane, and cis- and trans-nonachlor. RL and MDL are the highest RL and MDL for the chlordane-related compounds.